THE

DENTAL PRACTITIONER

monthly journal for the Practitioner and his Staff

VOL. IV, NO. 5 JANUARY, 1954

Incorporating the Official Supplement of
The Dental Laboratories Section of the Surgical Instrument Manufacturers' Association

CONTENTS

Editorial: "Aequo Pede Propera"

The British Society for the Study of Orthodontics
HAROLD CHAPMAN, F.D.S. R.C.S. (Eng.)

The Design and Construction of Bridges (continued)
N. LIVINGSTONE WARD, L.D.S., D.D.S., and
R. V. P. CAMPBELL, H.D.D., L.D.S. R.C.S. (Edin.), D.D.S.

Critics' Corner National Health Service Notes

The Sheffield Dental School: Opening of the New Charles Clifford Dental Hospital

The Proceedings of the British Society of Periodontology:
The Experimental Investigation of Periodontal Disease in the Ferret and in Man, with Special Reference to Calculus Formation: J. D. KING, Ph.D.

Art and Dentistry Book Review Dental Service Notes

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THE DENTAL PRACTITIONER

A Monthly Journal for the Practitioner and his Staff

(Incorporating the Proceedings of the British Society of Periodontology, the Transactions of the British Society for the Study of Orthodontics, and the Official Supplement of the S.I.M.A.—Dental Laboratories Section)

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CONTENTS

	PAGE
EDITORIAL: "AEQUO PEDE PROPERA"	137
THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS — *Harold Chapman, F.D.S. R.C.S. (Eng.)*	138
THE DESIGN AND CONSTRUCTION OF BRIDGES (*continued*) — *N. Livingstone Ward, L.D.S., D.D.S., and R. V. P. Campbell, H.D.D., L.D.S. R.C.S. (Edin.) D.D.S.*	139
CRITICS' CORNER	151
NATIONAL HEALTH SERVICE NOTES	151
THE SHEFFIELD DENTAL SCHOOL: OPENING OF THE NEW CHARLES CLIFFORD DENTAL HOSPITAL	152
THE PROCEEDINGS OF THE BRITISH SOCIETY OF PERIODONTOLOGY: THE EXPERIMENTAL INVESTIGATION OF PERIODONTAL DISEASE IN THE FERRET AND IN MAN, WITH SPECIAL REFERENCE TO CALCULUS FORMATION — *J. D. King, Ph.D.*	157
ART AND DENTISTRY	163
BOOK REVIEW	164
DENTAL SERVICE NOTES	164
OFFICIAL SUPPLEMENT OF THE SURGICAL INSTRUMENT MANUFACTURERS' ASSOCIATION—DENTAL LABORATORIES SECTION	165

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References to dental literature should be recorded in the text, with the name of the author and the year of publication in parentheses. In the bibliography they should be arranged in alphabetical order in the following form, the abbreviations of periodicals being those adopted in the *World List of Scientific Periodicals*, e.g.:—

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LEWIS, R. W. B. (1947), *The Jaws and Teeth*, 2nd ed., 471. London: Science Publishing Co.

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THE

DENTAL PRACTITIONER

A Monthly Journal for the Practitioner and his Staff

Vol. IV, No. 5 January, 1954

EDITORIAL

"AEQUO PEDE PROPERA"

THE advent of the New Year brings considerable changes in the DENTAL PRACTITIONER which will be brought about during the next few months. No one can afford to stand still in a growing profession, and it has been decided that in future the journal will become almost entirely scientific, dealing with each special phase of dentistry. This does not mean that it is to change beyond recognition. The basic practical appeal will remain, and it will not encroach on any aspect of dentistry other than the purely scientific and treatment side. Both the British Society of Periodontology and the British Society for the Study of Orthodontics are fundamentally practical in their approach to their individual problems. The basis of any Society must be an appeal to the professional instincts of its members even if at times wandering into the realms of abstract theory. The theoretical research performed must prove itself in the achievement of better practice to the good of the patient and the operator. We are morally bound as members of a healing profession to seek new methods of treatment based on our changing knowledge of disease. It is the obligation of this journal to publish the results for the general practitioner in a recognizable form so that the abstruse becomes plain and understandable. The Editorial Board are fully conscious of their responsibility in this matter, whether it concerns articles, abstracts, or book reviews. Although dentistry has its own specialities it is still one single subject. It cannot be divided into separate watertight compartments, and an attempt must always be made to add up the individual parts to make the whole. Specialities of whatever branch are bound to overlap. This aspect must be as broad as possible, while achievement in the small ways must, through time, develop into achievement in the whole. We must proceed at a steady pace—*Aequo Pede Propera*—until we reach our goal.

HONOUR FOR Dr. E. WILFRED FISH

ALL members of the profession will wish to congratulate Dr. E. Wilfred Fish, whose name appears in the New Year Honours list as a Knight Bachelor.

Dr. Fish, by his long devotion and service to the cause of dentistry, has earned a world-wide reputation. He has distinguished himself in all aspects of dentistry and by his clinical research and writings, as well as by his administrative ability, has proved himself an outstanding member of the profession.

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

By **HAROLD CHAPMAN**, F.D.S. R.C.S. (Eng.)

THIS journal will publish the proceedings of the above Society from January, 1954; the discussion following the reading of the papers will be included; this is a reversion to the practice before 1946 and adds considerably to the value of communications. The first paper, the Presidential Address of W. Trevor Johnson, entitled "The Orthodontic Problem", will appear in the February issue. It is appropriate in these circumstances that there should appear in this issue a brief review of the origin and activities of the Society.

On the cover of the by-laws appear the words "Founded in 1907". The first ordinary meeting of the Society was held in January, 1908, but several meetings were held previously in preparation for this event, the first on Oct. 21, 1907, by invitation of George Northcroft, a photostatic copy of which is reproduced in the Society's Transactions for 1942–3.

These meetings took place at 115, Harley Street, where Northcroft practised and lived; it was due to his initiative that these meetings were held, perhaps stimulated by the writer, who at that time was his assistant, having returned from the States in 1906 after nearly two years' study which included a course at the Angle School of Orthodontia at St. Louis, Mo.; this and other fortuitous circumstances gave the writer special interest in orthodontics. The American Society of Orthodontia had been founded in 1901 and Northcroft conceived the idea that such a Society be started here; with this object in view he called the meetings referred to, inviting a dozen or so friends likely to be interested. These included J. H. Badcock, who became the first president; W. Francis Mellersh, the original honorary treasurer; and A. C. Lockett, the first honorary secretary. It was Lockett who had influenced the writer to go to the Angle School, which they attended together.

The object of the Society is "the promotion of the study of Orthodontics"; this has been strictly adhered to; it is noteworthy that the changing times have not diverted it from its course. Meetings are held in London seven times a year, including a demonstration meeting, though a variation is under consideration; the regular large attendance is evidence of the popularity the Society enjoys.

The Society began with a membership of about thirty; today it is 389, including approximately 40 overseas; the net increase in 1953 was 19. The Transactions have been published since the Society was founded, and since 1921 annually in one volume with the exception of the war years. There were no ordinary meetings of the Society during 1917–18 and in 1941, although the officers met to keep the Society in being. The first Editor was Wm. Rushton, who was also Editor of the *Dental Record* in which papers, discussions, etc., appeared prior to the publication of the annual volume. Rushton became President in 1911.

There is a considerable demand for the Transactions, particularly from overseas, by libraries and private individuals. The Northcroft memorial lecture, established in memory of the founder of the Society, is given in November, sometimes by a member, at other times by a specially chosen scientist. Speakers from abroad are not infrequent, among them have been de Coster, of Brussels, the late George Villain, of Paris (his paper regrettably not published), and the late John V. Mershon, of Philadelphia; the most recent was Kenneth Adamson, of Melbourne.

The Society possesses a museum of considerable value, for here may be gained a knowledge of normal occlusion and some of its variations. Such knowledge is essential to the general practitioner as well as the orthodontist. The interesting material it contains includes serial models and face masks of the

children of two former presidents from soon after birth until the age of 18 in one case and 30 in a second. Another feature appreciated by members is the library which is constantly being added to. Gifts to both these are appreciated; copies of earlier issues of the Society's own transactions are welcomed as requests for them, particularly by younger members, are frequent and often cannot be fulfilled.

THE DESIGN AND CONSTRUCTION OF BRIDGES

By N. LIVINGSTONE WARD, L.D.S., D.D.S.

Assistant Director of Conservative Dentistry, London Hospital Dental School, Consultant Dental Surgeon, London Hospital

and R. V. P. CAMPBELL, H.D.D., L.D.S. R.C.S. (Edin.), D.D.S.

(*Continued from page* 115)

PART III

STUDY MODELS AND GENERAL CONSIDERATIONS

THE use of study models has been briefly mentioned in Part I, and it is only after a decision that the biological basis is sound, and the mechanical factors apparently satisfactory, that impressions for study models are taken. After mounting on an articulator which will show lateral and protrusive movements of the jaw, the models are carefully studied in function. In examining the mouth a good mental picture of the arches in occlusal movements from the labial and buccal aspects may be obtained, but on an anatomical articulator this can also be recorded with the additional important view from the lingual. This latter view often shows unsuspected points of interference and possible causes of lateral or displacing pressure. When these facts are known steps can be taken to eliminate them and make the conditions more nearly ideal for the insertion of a bridge.

Although not always necessary, a surveyor can be a great help in determining the line of insertion of a bridge, and if the abutment teeth are tentatively carved, surveying at intervals during this process will determine the minimum amount of tooth substance to be removed in order to obtain parallel or slightly converging surfaces. The value of seeing prepared abutments on a model is considerable, and their use as a guide or as a comparison to the actual preparation in the mouth must be obvious to all.

As stated in Part II under "General Considerations in Bridge Design" the ideal method of retention is by the use of three-quarter crowns on all abutments. The preparation has advantages as a standard type of bridge attachment for both the patient and the operator. The most important are as follows:—

They do not require any great amount of cutting or drilling into the tooth substance.

The preparation is done almost entirely by surface grinding. Few changes of instrument are required.

Corresponding surfaces on different abutments may be prepared simultaneously, which is an aid to parallelism.

The eye quickly learns to assess when surfaces are parallel or slightly converging.

Control of angulation of the handpiece becomes automatic, and ensures that parallel surfaces are obtained or that just the right amount of converging without excess removal of tooth is accomplished.

The minimum amount of tooth should be removed, and it should be noted that often there is no need to destroy the whole thickness of the enamel. For instance, where a thin veneer of gold will not interfere with occlusion, or where the surface is naturally of the required shape for the abutment preparation, then only the amount of work necessary to bring it within the principles laid down for abutment preparation should be done. Enamel should not be removed merely because it is

enamel on an area of the tooth which is going to be covered by an attachment.

If too much tapering of abutment surfaces is done then the retention of the bridge is seriously weakened. The cutting of grooves which are an addition to retention on the mesial and distal of the preparations is rendered difficult, because these must be parallel to each other in all vertical or appropriate planes, and this may mean that a

Fig. 15.—Retention grooves cut in the direction of the arrows would endanger the pulp.

groove starting at the occlusal becomes a pin hole in the dentine which might endanger the pulp. (*Fig.* 15.)

A properly constructed bridge when placed in position without cement should have a friction fit which will hold it securely whilst being checked for occlusion, and any possible points of interference with the movements of mastication. This does not mean that the bridge is held by a wedging action between the abutments. There must not be any adventitious strains or stresses on the abutments, the retention being due entirely to the accuracy of the preparations and the close adaptation of the attachment. When finally placed this bridge will have the thinnest possible layer of cement between the three-quarter crowns and the teeth, which will act mainly as a seal and produce a union of great strength.

Diamond points, wheels separating disks, and safe-sided disks have been found to give the maximum grinding efficiency with the least generation of heat. Safe-sided stainless steel backed carborundum disks are also useful and have one advantage over their diamond counterparts in that they are thinner and can go through contact points more easily. The wear on these instruments is so slight that they remain accurate, which is most important in preparing smooth surfaces.

The diamond accessories have an advantage over those made of carborundum, as they can cut either enamel and dentine, or enamel and dentine and any filling material at the same time to an equal degree with uniform light pressure. This cannot be done with ordinary stones, since for maximum efficiency they require a different toughness of embedding material holding the abrasive crystals for each medium of different hardness they are grinding.

This is why stones wear unequally, and may produce surfaces with slight undercuts which are difficult to detect, waste time and tooth substance in correction, and may even spoil the preparation.

In outlining the following practical steps in preparing abutments it will be assumed that where caries was present it has been successfully removed, and where fillings existed, that they have also been removed and the cavities checked for underlying decay. If those cavities are on the occlusal or lingual aspects of the tooth, the normal contour of the surface must be restored by cement or amalgam or both. When the cavities are on the mesial or distal aspects or both of molars and bicuspids the contour of the tooth is not restored. Canines, lateral and central incisors which have cavities on the mesial or distal, or both, have their

Fig. 16.—Gold inlay restoring contour at the neck of the tooth.

contours restored. Where a cavity extends beyond the enamel margin into the neck of a tooth, and where it would require too much paring away of sound dentine to incorporate this cavity into the general preparation, then a small gold inlay should be placed to restore contour in the neck area, and also in the crown as far as will ensure it being covered to an extent of about 2 mm. by the margin of the three-quarter crown. (*Fig.* 16.)

Having determined, from examination of the mouth and the study models, the classification

of the bridge, the preparation of the abutments is begun. Local anæsthetic is always used, and great care not to overheat the tooth is exercised. It is suggested that a water spray should always be used.

The following system, which is not rigid, as the order of various steps may be interchanged,

Fig. 17.—Removing contact points and any undercuts on mesial and distal surfaces of abutment teeth. A, Posterior teeth; B, Anterior teeth.

is recommended as a guide to a sound practical routine:—

1. Remove contact points of abutment teeth.

2. Remove undercuts on mesial and distal surfaces, and make those surfaces either parallel or slightly converging toward the occlusal, keeping in mind the direction of

Fig. 18.—Reducing the level of the occlusal surface.

insertion of the bridge. A slight tilt or angulation of the tooth will necessitate a little extra grinding on one side and a little less on the other. (*Fig.* 17.)

3. Reduce the level of the occlusal surfaces of molars and bicuspids to allow for a thin veneer of gold (*Fig.* 18.) Bevel labiolingually the incisal edges of canines and central incisors.

4. Remove any occluso-gingival curvature on the lingual of molars and bicuspids, and obtain smooth continuity with the prepared mesial and distal surfaces (*Fig.* 19). On canines and centrals reduce the lingual enamel to allow for a thin veneer of gold.

5. Decrease the bucco-lingual width of molars and bicuspids by grinding off some of the lingual aspect of the lingual cusps (*Fig.* 20).

6. Make parallel grooves in the mesial and distal surfaces of all abutments along the line of insertion of the bridge (*Fig.* 21). These grooves must be cut in tooth substance, so any

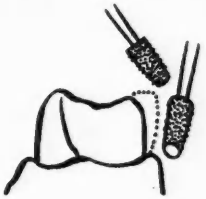


Fig. 19.—Removing the occluso-gingival curvature on the lingual surface, and decreasing the bucco-lingual width of the occlusal.

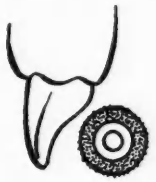


Fig. 20.—Labio-lingual bevelling of incisal edge of anterior tooth, and reduction of lingual enamel.

cavity on such a surface in a molar or bicuspid is converted into a modified Black type box cavity in place of a groove (*Fig.* 22). Where cavities exist both mesially and distally the box preparations are usually joined by a groove along the occlusal. In short thick

canines or centrals where the grooves would not be long enough to have a real retentive value, three pin-holes are drilled approximately

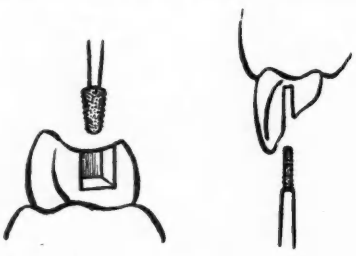


Fig. 21.—Making retention grooves on mesial or distal surfaces. **A**, Posterior teeth; **B**, Anterior teeth.

2 mm. deep, one at the cingulum and one each near the mesio-incisal and disto-incisal angles. The pin-holes must be parallel to each other and run in the line of insertion of the bridge. (*Fig.* 23.) A single pin-hole at the cingulum may be used as a substitute for one groove on a canine or central where the contour of a mesial or a distal surface has had to be restored.

Fig. 22.—Box cavity preparation for retention instead of groove.

Where a Class IV bridge is designed the abutment receiving the stress breaker must have sufficient tooth removed so that a step may be incorporated in the attachment to accommodate the stress breaker. For this a slice cut with a box cavity—not a retention groove—must be included in the three-quarter crown preparation. The sides of the step cut out in the wax pattern for the attachment must be parallel to the line of insertion of the bridge. The base should be flat and slope gently inwards so as to deepen the step as it extends into the gold and form a lock to receive the rest.

Although the three-quarter crown is regarded as the ideal attachment, there are conditions where modification or extension of the preparation must be considered. The following are the accepted variations:—

a. Where a third molar or any molar with a short crown is used as an abutment, the buccal surface is included in the preparation, and a shell crown is made. If the crown is very short, retention may be increased by the addition of occlusal pins.

b. Where a lateral incisor is used, a jacket crown preparation with a distinct shoulder, extra wide on the labial if possible, is made.

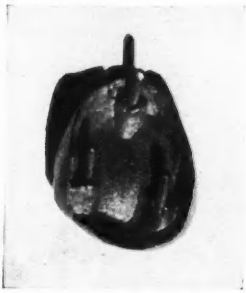


Fig. 23.—Attachment for three-pin three-quarter preparation.

A gold shell crown fashioned to take an acrylic veneer is constructed. The crown is extended rootwise beyond the shoulder to form a narrow collar around the neck of the tooth. This gold collar is essential for strength, and while it should be hidden beneath the gum margin as far as possible without causing irritation, it must not be sacrificed for æsthetics.

c. Canines and centrals which have extensive mesial and distal cavities are prepared for the same type of attachment as a lateral incisor.

d. A central incisor which is slightly rotated to show the mesial aspect, may be prepared as for a pin three-quarter crown, but have the mesial slice omitted and the preparation stopped on the lingual just where the curve round to the mesial begins (*Fig.* 24). This is purely for æsthetic reasons.

e. In a molar where the lingual surface is extremely bulbous, and the requirements of a three-quarter crown would remove rather much tooth substance, an M.O.D. inlay preparation is made with slice cuts and grooves or modified box cavities mesially and distally. The cusps must be tipped and whole occlusal surface included in the preparation.

Fig. 24.—Attachment for three-pin three-quarter crown with the mesial slice omitted.

IMPRESSIONS

The impressions for bridgework are divided into two parts:

(1) Impressions for making the attachments for the abutments;

(2) Impressions for constructing the bridge.

In (1) the impressions can be either (*a*) Direct, or (*b*) Indirect.

a. Direct impressions depend almost entirely on the skill of the operator. In the posterior part of the mouth they are difficult to do, even where inlays are being used in place of three-quarter crowns.

For anterior teeth the following technique is useful: A matrix band (Lennox or similar type) is fitted so that on the lingual it passes under the gum margin a little farther than the three-quarter crown is expected to go. The band is so shaped that it flares out from the tooth. A softened cone of inlay wax is pressed firmly into the space between the band and the tooth.

After chilling, the band is carefully removed without dislodging the wax. The contact point with the contiguous tooth is now added, and the margins of the wax trimmed to the outline of the future three-quarter crown. The wax is now removed and the impression surface is washed and painted with investment which is built up to form a small knob. When this has hardened, the excess lingual wax is trimmed away, care being taken not to interfere with the areas already prepared in the mouth. The thickness of the wax can be gauged by its colour, as the investment can be seen shining through as the wax is thinned. This method can be used equally well for the three-quarter crown with lateral groove or pin retention.

b. Indirect impressions can be made by various methods, but most require copper bands and a heat-softened impression material such as composition sticks or wax.

To obtain a good abutment impression a little local anæsthetic is put in the gum margin and a seamless copper band is selected which fits snugly around the tooth at the gingival. It is scribed to the contour of the gum, and for a three-quarter crown is further trimmed, if necessary, on the labial or buccal surface which is not included in the preparation where there may be undercuts. For an M.O.D. inlay there will be extra trimming on the lingual as well as on the buccal to avoid undercuts, but for shell crowns contouring to the gum line is all that is necessary.

The essentials for a copper band impression material are that it must soften easily, flow smoothly, and set hard when chilled. To load a copper band for an impression, some of the impression material is softened, usually in a flame, and the band is heated. The impression material is pressed into the band, taking care not to entrap any air, and as the band is hot it clings to the copper and does not pull away from it when the impression is taken. It is passed through the flame to get a smooth surface, dipped into hot water (approximately 150° F.) to temper, and immediately carried to the tooth. Much of the success of an

abutment impression depends on the initial placing of the band. The operator must try to aline the tube so that it can be passed over the crown of the tooth in the line of insertion of the bridge straight to its final position in one smooth movement. When it is properly seated—that is when all the preparation area is covered by the metal—it is held firmly in that position and pressure is exerted, usually with the thumb, on the impression material to ensure that it closely invests the said area. It is now thoroughly chilled by a stream of cold water. Excess impression material which has been squeezed out at the gingival is carefully broken off, and the band is removed by a straight pull in exactly the reverse direction to which it was placed. In this way an impression can be obtained without damage to its fine detail.

If a pin three-quarter crown is being made, exact sized platinum or plastic pins should have been placed in the pin-holes and left protruding sufficiently to be firmly held in the impression. A 23 gauge platinum wire will fit a $\frac{1}{4}$ round bur hole. The direct method is preferable here, but if the indirect is used, the impression should be cast in investment, and after removal of the copper band and impression material the pattern should be waxed up without the pins having been moved. A probable inaccuracy in this attachment is the contact point with the next tooth, as no record of this has been taken. The pattern can be tried on the tooth using the indirect-direct technique, and the contact point corrected then, but this is difficult and the pattern is very liable to fracture.

Except in the cases of attachments with pins, all the dies from abutment impressions must be made either in amalgam or by electro-deposition of copper. For the former, the impression is wrapped in a short strip of rather stiff paper which protrudes about half an inch beyond the impression. This is sealed on with sticky wax, and the whole embodied in a larger paper cylinder filled with plaster-of-Paris. When the plaster has set the impression is packed with amalgam, using a very soft mix at the beginning, then an increasingly harder mix with growing pressure until all the excess mercury has been expelled and the mould is filled with a solid mass of amalgam. When this has hardened the plaster is cut away and the copper band and impression material removed with warm water. The root portion of the die is tapered slightly, which enables it to be removed easily from a plaster model.

In the electro-deposition of copper method, the impression is connected to the cathode terminal, then surrounded by a thin sheet of wax which protrudes approximately 3 mm. beyond the gingival end of the band. This wax is sealed on with a hot instrument and the impression surface is thinly but completely coated with colloidal graphite.

After the impression has been in a copper-plating solution for an adequate time it is removed and carefully washed. A strip of paper is then wrapped around the band, extending beyond it to form a root portion, and is filled with stone plaster. After softening, the composition complete with copper band is removed, and the root portion trimmed in the same way as in the amalgam die.

An accurate impression will give an accurate amalgam or copper die, but this single die is not sufficient to make either a three-quarter crown or any other attachment which will meet the requirements of occlusion and contact with the neighbouring tooth.

There are several methods by which this can be obtained. A plaster impression of the area of the abutment may be taken. This should include a sufficient number of teeth to give an accurate registration of the bite with the opposing teeth. A compositon impression of the opposing teeth in wax may be taken at one and the same time. Hydrocolloid or alginate impressions may be taken instead of plaster, but there is more liability to error in placing and holding the dies in position whilst casting the model.

The abutment dies are placed in their appropriate positions in the area impression. If a die will not go properly into position because of interference by some part outside the impression area—for instance, the labial surface of a three-quarter crown near the gingival which was not included in the impression—then that part must be trimmed

away to get accurate seating before the model is cast. The stone plaster root portion of a copper die must be varnished or treated with a separating medium so that it can be removed from the model without damage. The root portion of a die should not be made symmetrical, as this may result in inaccurate replacing once it has been removed from the model. With a plaster impression it is usually possible to place the die in position and seal it there with a little sticky wax so that it stays accurately in place while the model is being cast. If there is any possibility of movement the die must be supported and steadied. A scaffolding of matches held together by sticky wax and linked to the top of the root portion in the same way will be found to be completely effective.

There are two quick ways of getting all the necessary data using wax. The first method is entirely indirect, and consists of taking a cube of ordinary pink wax which will cover the abutment tooth and its neighbour. The wax is softened, pressed over those two teeth and moulded labially and lingually to cover the entire surfaces. A centric bite is taken, and the patient is instructed to press the wax against both the upper and lower teeth with the tongue. Meantime the wax is pressed in a like manner on the buccal with a finger. It is now chilled, taken out, and further chilled. In this hard condition it is replaced in the mouth, checked for bite, and finally removed. When casting, the teeth opposing the abutment and its neighbour are cast first, then the die is put in position, sealed with a trace of sticky wax, and the model completed.

No matter which way models of the abutment area and the opposing segment are obtained, they should be mounted on small simple hinge articulators before discarding the bite records.

The second method incorporates in part the direct technique. When the abutment impression has been taken, or, if preferred, when the die has been made, a small piece of inlay wax is softened and pressed on to the abutment tooth so that the retention groove next to the neighbouring tooth is filled and a good contact point is made. The wax is also pressed over the occlusal surface of the abutment tooth, and a centric occlusal record is taken. Any wax obstructing the removal of this record is trimmed away, but the contact point is preserved.

When placed on the die the remaining excess wax is carved away, and the pattern is completed all without interfering with the contact point or the occlusal registration. Light brushing with a fine flame to get an all-over smooth surface will not spoil the record areas if carefully done. In this last method it should be noted that no impressions are taken as no area model is required.

When the attachments have been cast they should be checked on the dies, then polished and finished like an inlay about to be cemented. It must be borne in mind that once a pontic has been soldered to an attachment little can be done to improve an unfinished surface next to the pontic. A rough or uneven part there will hold food debris and create a stagnation area.

The attachments are now tried in the mouth, checked for fit and marginal adaptation, also for occlusion and any interference with the opposing teeth in function.

MASTER MODELS

When the three-quarter crowns or other forms of attachment have been found to be correct in all detail, the next step is to make the master model. A part impression model, that is a model of an area little more than the bridge or even half the arch, is not sufficient to give an accurate registration of the occlusion with a mould of a similar area of the opposing jaw. Such models cannot be used to show the dental arches in function. With the attachments in position on the abutments, a full plaster impression must be taken. Plaster is essential to hold the gold castings accurately in position whilst the model is being cast.

The impression of the opposing arch should be taken either in plaster, hydrocolloid, or alginate. Composition is not accurate enough, because of its liability to drag, unless of course a sectional impression is taken. Centric and inferior protrusive bite records are made, and the operator now requires only the shade

to complete the series of records from the mouth.

The impression with the bridge attachments is examined to ensure that they are firmly seated, then the gold is thinly coated with either whiting or colloidal graphite. Fusible metal is used to cast this model. There is no stone plaster available at present from which to make models sufficiently strong and hard that they would be certain not to fracture when the attachments were removed, and which would stand up to the wear of frequent removal and replacement of the various bridge components without becoming rubbed and inaccurate.

When the fusible metal is cast it must not be too hot or it will bubble in the impression and give a bad model. The proper temperature to cast is just before the metal sets. This will lessen the possibility of error by contraction as the metal will virtually set on contact with the plaster.

The impression of the other arch is cast in stone plaster, and the models are mounted in centric occlusion on some form of anatomical articulator and the necessary adjustments made to accord with the inferior protrusive record.

It can be mentioned here that there is a technique with hydrocolloid impressions taken in a particular way and a very hard stone plaster, in which the bridge is constructed wholly on the models and finished ready for insertion without references to the patient between the impression stage and the cementing.

PONTICS

The pontic or suspended member of a bridge is usually, as far as the patient is concerned, the part on which first appreciation depends when a bridge is fitted. This is naturally so in the anterior part of the mouth, and it must always be remembered that while æsthetics is not the most important factor to the operator, it is probably the most important to the patient.

Briefly the requirements of a pontic are that it restores the function of the tooth it replaces, that it is biologically acceptable to the tissues, that it can be easily cleaned, and that it complies with the demands of comfort and æsthetics.

As stated under "Pontic Design", a pontic should be as simple as possible, and the simplest consists of a gold platform between the attachments, which is sufficiently strong to withstand the stresses of mastication without bending or yielding. This is the only all-metal pontic which should be used.

Modern pontics are mostly of a combination type, being composed of gold and porcelain or gold and acrylic. To keep the work as simplified as possible, gold and porcelain, though very efficient, are not easily made and for this reason are not recommended, except as a facing on a slotted gold backing. As the three-quarter crown is advised as a standard attachment, uniformity can be extended to the pontic by constructing them on the same basis. Viewed from the lingual or the occlusal surfaces it will appear as a three-quarter crown, and from the labial or buccal aspect the acrylic inset will simulate the appearance of the missing tooth.

The three main types of pontic, i.e., the gold platform, the gold and porcelain, and the gold-acrylic, have their own advantages and particular area in the mouth where they are most suitable.

a. The all-metal pontic is confined to the posterior part of the mouth, and is mainly used for replacing molars. It can be used only in Classes 1 and 4.

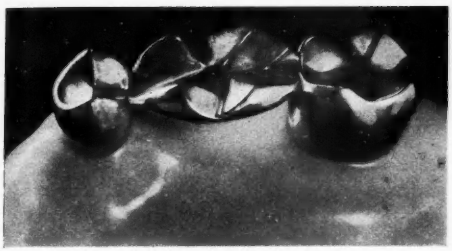
b. The facing, made either in porcelain or acrylic, with slotted retention for a metal backing, can be used in any part of the mouth and in all four classes. It is recommended primarily to replace canines and incisors, as too much gold would be required to complete posterior pontics, and the bridge would be unnecessarily heavy.

c. The three-quarter crown type gold and acrylic combination pontic can be used in any part of the mouth, and in all four classes. It is recommended principally to replace molars and bicuspids.

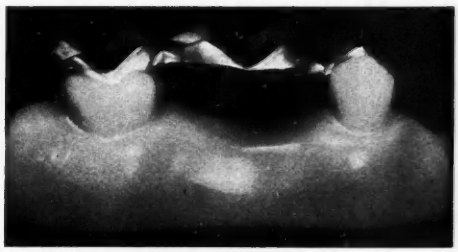
The construction of these pontics is as follows:—

a. **The All-metal Pontic.**—With the models mounted on the articulator, and the attach-

ments in position, the space between the attachments is filled with plaster almost to the level of the contact points and given a flat surface. The buccal wall of the plaster is trimmed to represent the outer wall of the missing tooth at that level, and the lingual is likewise trimmed, but so that the normal bucco-lingual width is slightly reduced. The flat top is treated with separating material, and covered with inlay wax to establish occlusion with the opposing teeth. Occlusal anatomy is completed in conformity with the lateral and protrusive movements on the articulator. A sprue wire is attached and the wax is removed, washed, and invested. After it has been cast it is polished and returned to the model. (*Fig.* 25.)



A



B

Fig. 25.—A, Lingual, and B, Buccal views : three-quarter crowns with all-metal pontic in position.

b. **The Facing with Metal-backing Pontic.**—A facing, suitable in size and shade, is selected and ground at the gingival to the contour of the gum. It is held in position by a piece of soft wax or pink wax applied to the lingual, and a face-bite is made in composition. The wax is removed, a metal backing is fitted to the facing, care being taken to see that the backing makes contact with the attachments while the facing is held in position by the face-bite. If there is any doubt regarding interference with occlusion, the backing should be fixed with soft wax, then the face-bite removed, and the occlusion checked, or the face-bite should be trimmed down to just below the incisal edges of the anterior teeth so as not to interfere with the articulator movements. The lingual anatomy is now completed in inlay wax, again taking care not to upset occlusal relations. To get a good union between the backing and the lingual gold which is cast on to it, a little solder should have been flowed over the backing after it was shaped to the outline of the facing. For the casting a sprue wire at right angles to the backing is attached to the wax at its thickest point. It is invested, cast, and finished in the usual way.

In a Class III bridge the bar connecting the pontic to the anterior of the two three-quarter crowns which form the anchorage of the bridge should be waxed up with the backing. A piece of thin tin foil should be burnished on the model from the three-quarter crown to the backing and the waxing up done on this. Two sprues should be used to get a strong casting without porosity. The bar should be oval in cross-section and polished all round.

Made in this way it is easily kept clean and will not irritate the tissue. After finishing it is placed on the model and checked. The tin foil should not be removed from the model until after the bar and three-quarter crown have been soldered.

In replacing an anterior tooth with a translucent tip a facing, in either porcelain or acrylic, may not be entirely satisfactory, and in such a case a jacket crown fitted to a gold core with the lingual surface adapted to allow approximately half to be covered with gold, as shown in *Fig.* 9 B and C (p. 112), will give a very good result.

A facing and a jacket crown have a great asset in that they are comparatively easily replaced in the case of accident.

Fig. 26.—Buccal view : three-quarter crown pontic with gold extended to make contact with the tissue. Retention of acrylic allowed for in the carving.

Fig. 27.—Buccal view : molar and bicuspid three-quarter crowns. Note vertical groove in contact point area of molar.

c. **The Three-quarter Crown Type Gold and Acrylic Pontic.**—The gold section of a gold and acrylic three-quarter crown type of pontic is exactly the same as a three-quarter crown would be for the tooth it replaces, except that as there is no free margin of gum for it to pass under, the gold is stopped approximately 1–2 mm. from the tissue. This allows a rounded edge of acrylic to be made and ensures that nothing sharp impinges on the gum. A modification may be made by ending the gold a little way past the contact point level—sufficient only to allow a strong soldered joint—or the gold may be extended to include the surface in contact with the tissue. In the latter case the pattern takes the form of an open faced box (*Fig.* 26).

Two different methods can be used to make the wax patterns for this type of pontic:—

In the first, the whole pontic is built up in inlay wax, and then carved out. Retention for the acrylic may be obtained in several ways. It may be allowed for in the carving. A sprue wire may be passed right through the occlusal to form a retention post when cast. The inside of the wax pattern may be filled with investment which can be drilled through the wax pattern when set to form small retention posts. The holes in the wax are easily repaired before the investing is completed. Or finally the pattern may be cast and a small hole drilled in the occlusal through which a gold or platinum pin is passed and soldered as a retention post (*Fig.* 28). Where the thickness of gold at the contact point on an attachment permits, and it usually does, it is extremely useful to cut a vertical groove there. A number one fissure bur sunk to half its diameter is sufficient. This groove is of great help in accurately replacing a wax pattern on the model for checking, and in exact placing of the subsequent casting. It strengthens the soldered pontic and attachment union (*Fig.* 27).

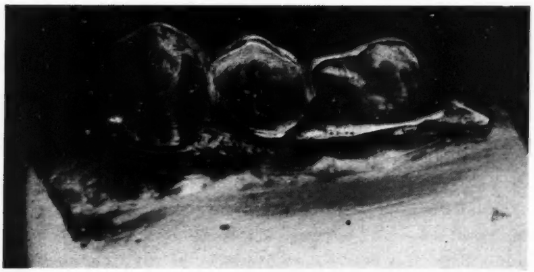


Fig. 28.—Similar view : three-quarter crown with soldered vertical retention pin.

In the second method an outline of the missing tooth at the neck or gingival level is

made on the model, reducing the bucco-lingual width to a little less than normal. The areas representing the interdental spaces between the abutments and the lost tooth are filled in with pink wax. This removes any undercut between the contact point of an attachment and the alveolus and helps to shape a model of the missing tooth which is now made. A little investment, mixed so stiffly that it can be handled, is moulded into the pontic area approximately to the size of the lost tooth, care being taken that contact is established with the opposing teeth. When the investment has set it is trimmed buccally and lingually to the outline on the model, then to a complete facsimile of the missing crown. It is removed from the model and the surfaces reduced in the manner of a three-quarter crown preparation. If the modified form is wanted the cutting away of the mesial, lingual, and distal surfaces is restricted to just a little past the level of the contact points, and if the extended form is preferred the surface in contact with the tissue is also relieved.

In making the three-quarter crown type of pontic and its modified form the accurate replacement of the investment mould on the model is easy because there is an untrimmed investment surface in contact with the model. The pink wax should be removed from the interdental spaces and vertical grooves, as previously described, made in the contact points of the attachments. The investment mould is covered with inlay wax according to the form of pontic prepared, and returned to the model. When it has been checked and corrected for occlusion and contact with the attachments, the investment is completed. This is done by adding a sprue wire, soaking the whole in water at room temperature for a few minutes, then painting over the entire surfaces with new investment, taking care not to dislodge the sprue wire. When this has set, it is again soaked and lowered into a casting ring full of investment.

Where a gold contact with the tissue is wanted there would be some difficulty in accurately replacing the investment mould if the whole preparation for the pontic were done at one time, because there would be no contacting surface left to act as a guide. When the mould is removed from the model for the first time only the surface in contact with the model is prepared. This is covered with inlay wax and put back on the model so that occlusion may be checked. Once this is correct the rest of the preparation is made, the pink wax is removed from the interdental spaces, the grooves on the contact points are cut out, and the wax pattern is completed.

In the case of a large molar pontic with a heavy bite, where it is felt that some extra strength is wanted, a hole should be drilled through the investment mould from the mesial to the distal at the level of the contact points. When the casting is made this bar will give all the additional strength that can possibly be required.

As previously mentioned, in a Class 4 bridge the attachment receiving the stress-breaker must have sufficient thickness for a step to be cut out. The pontics used in this class are usually those described in (*a*) and (*c*), and they are prepared as detailed for the soldered joint surface, and on the other contacting surface the step is waxed in with the pattern, so a very accurate fit is obtained.

The multiple bridge shown in *Fig.* 2 A–C (p. 105) is made extending the principles of pontic construction (*b*) and selecting all the required facings at the one time. Similarly, by adapting the principles of (*c*), multiple posterior bridges can be constructed. In short, pontics for any combination of the four bridge classes can be made by the methods described.

SOLDERING

When the gold of a pontic has been polished, checked on the model for occlusion and points of interference, and found to be correct, the next stage is soldering. A little pink wax is put on the contact points, and the occlusal and lingual surfaces covered with quick-setting plaster. The pink wax is not used in an attempt to join the segments together, but only to keep the plaster clear of the contact points. The plaster is built up sufficiently to enable the impression to be removed in one piece. The attachments and pontic are removed from the

model and placed in their appropriate positions in the impression. A little more pink wax is now added to the contact points, and the plaster treated with separating medium.

The gold is coated with investment, which is then built up into greater bulk than the plaster. This is done to avoid the danger of breaking the investment when the plaster, which is much the harder of the two materials, is being removed. The small amount of pink wax is easily disposed of with boiling water. When the investment has dried it is heated, gently at first, then more strongly, until a point near soldering temperature is reached. This will enable the soldering to be done quickly and so will not expose the gold to prolonged application of the blow-pipe.

The minimum amount of solder should be used. As the bridge is cast in hard gold—18-carat platinized gold is suggested—the solder should be 2 carats less.

When the soldering has been completed, the gold should be allowed to cool to a dull red before plunging into cold water. This is to preserve the temper of the gold. To clean the bridge, it should be put into an acid bath and the bath heated until the acid boils. The bridge itself should not be heated and dropped into cold acid.

COMPLETING THE PONTICS

After a bridge has been soldered and re-polished, it is tried in the mouth. It should go to place easily yet firmly, and stay in position while all necessary checks are being carried out. It is usually advisable to try the metal chassis of a bridge in the mouth before adding the acrylic and completing the pontics.

If all is satisfactory slot retention facings can be added immediately, but for the other combination pontics, the bridge must be put back on the model.

The acrylic inset for the three-quarter crown type of pontic and its variations is made up on the model in white wax, and if heat-cured acrylic is being used, the bridge is flasked and the acrylic processed in the usual way. Where the acrylic comes into contact with the tissue the authors prefer to use heat-cured acrylic. The open-faced box pontic where gold is in contact with the tissue may also be flasked and processed with slow cold-cure acrylic, or the bridge may be embedded in composition and a face-bite for the pontic also made in composition. In the latter case, when the white wax has been scraped away and the last traces removed by a solvent such as methylated spirit, the gold surface is treated with an opacifier and the acrylic packed in. It is then covered with a piece of thin cellophane and the face-bite pressed into position. If the setting time is not too slow, it can be held under pressure for the necessary length of time, or if that is too long it should be bound tightly with cord and set aside until hardening takes place.

CEMENTING

A bridge can be ruined in the final process of cementing. Too thick a mix can raise the bite of a bridge by a millimetre or more, so great care must be taken to get a strong mix which is at the same time sufficiently plastic to be squeezed out when the bridge is pressed to its correct position. This can only be got by using a cold slab, and adding the cement powder to the liquid in a manner which retards setting. If mixed in this way the powder-to-liquid ratio can be increased, yet the resulting mix is plastic, slow setting, and exceedingly strong. Once a bridge has been cemented it should be left for a minimum of twenty-four hours before any final adjustments are made.

SUMMARY

The design and construction of modern bridge work in dentistry has been described and discussed from the point of view of the general practitioner in this country. A classification of bridge design is presented together with the simple methods of construction. Methods involving specialized materials not generally obtainable in this country are not included.

We have to thank Mr. A. M. Horsnell, Director of Conservative Dentistry, London Hospital Dental School, for permission to publish the completed cases; and Mr. Broadberry, of the London Hospital, for the photography.

CRITICS' CORNER

(Under this heading we print letters which discuss points arising from articles which have appeared in the DENTAL PRACTITIONER.)

Nov. 9, 1953.

To the Editor,
Dear Sir,

What I have proved in my work is that a calcium-reactable fluoride (as distinct from calcium fluoride or some organic fluorides) will react with body calcium at all levels of concentration, however small, because bone has been demonstrated to be capable of progressively withdrawing and retaining as a solid one of the end-products of the reaction between a calcium-reactable fluoride and any calcium salt. This is the biochemistry of fluorides, and offers the only biological explanation to account for mottling of teeth. It was further demonstrated that such low calcium-reactable fractions as 0·16 (Sunderland), 0·33 (South Shields), 0·39 (West Hartlepool) can bring about a progressive fluorosis in time in those who drink such water supplies. The effects begin with a symptom known as mottling of enamel followed by degeneration and subsequent calcification of the contents of the pulp chamber and a sclerosis of the arterioles, leading to a premature ageing of the alveolar process and its attachment apparatus, which, in turn, results in early periodontal degeneration.

It has been demonstrated that the same type of fluorosis occurs in industry where workers are exposed to fluorine. From a ten-years' study of workers exposed to industrial fluorosis, the same type of pulp and periodontal degeneration has been observed, and from a study of children who have played among cryolite dust mottling and the same type of pulp degeneration has been observed. From an examination of thousands of extracted teeth from fluorine areas the low level of tartar deposit from even teenagers was indicative of early periodontal degeneration. These observations are in direct accord with the biochemistry of fluorides. In one area of Texas the tartar resembled a deposit of fine sand between the roots of six-year molars.

I have drawn a sharp distinction between the fluorine which is imbibed in tea or soup, or taken in any other food, and that which it is proposed to add to the water supplies. Calcium-reactable fluoride which has passed through the metabolic processes of plant, fish, or animal, will become detoxified or changed by reaction to calcium fluoride or an inert organic fluoride which is incapable of mottling teeth, providing water containing calcium-reactable fluoride is not drunk concurrently or is not used in the preparation or manufacture of such foods. The danger of mottling and other progressive changes from foods will exist if the fluorination of drinking water is forced upon the public. (*Dental Magazine*, August, 1953, and *Dental Digest* in the Press.) Mr. Allwright need not concern himself any further about the fluorine in tea, which fluorine, although still cumulative, does not really affect the issue as to whether or not sodium or sodium silico fluoride should be added to drinking water. Incidentally, I did not boil the tea for 10 minutes. After the boiling water was poured on the tea it was allowed to stand (or brew) for 10 minutes and then filtered.

We have both the biochemical reason and the clinical evidence to prove that progressive fluorosis does occur in areas where enamel mottling is a symptom, whether faint or obvious. Those who would push forward their fluorination programme should have been interested in such evidence, but it appears they are not.

As regards the point Mr. Allwright raises about the Graph I produced from the work of Forrest, Parfitt, and Brainsby, the purpose of this was merely to show that it was not possible for these authors to conclude from their work that the delay in the onset of dental caries was not five years (Weaver) but rather ten years (Deatherage and McKay). It is for these authors to explain the steep rise shown in tooth loss in their graph between the ages of 31 and 40.

Yours, etc.,
CHARLES DILLON.

Caladh,
Fort William.

NATIONAL HEALTH SERVICE NOTES

CERTAIN dental charges have been repealed by regulations. They were imposed under the National Health Service Act, 1951. The charges concerned are those on dentures supplied as part of a course of clinical teaching at certain teaching hospitals. These are Guy's Hospital, King's College Hospital, the United Newcastle-upon-Tyne Hospitals, the United Leeds Hospitals and the United Liverpool Hospitals. The regulations are the National Health Service (Remission of Dental Charges) (No. 2) Order, 1953.

Fluoride Treatment of Teeth

Mr. William Ross asked the Secretary of State for Scotland if he would state the areas in which an effort was being made to reduce dental decay by the application of solutions of sodium fluoride, and what knowledge had been gained from these efforts. Mr. J. Stuart informed him that work of this kind had been carried out among school children in Dundee, Edinburgh, and Fife. While it promised to afford a measure of protection against dental decay it would be some years before final conclusions could be drawn about its place in preventive dentistry.—(*T.*, *Nov.* 24.)

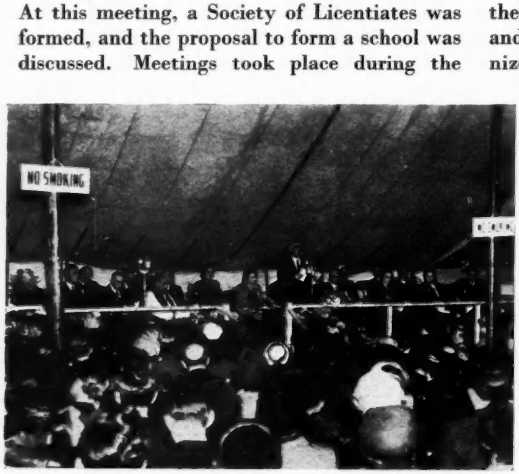
Removal of Name

The name of John Davies, of 25, Uxbridge Road, London, W.12, has been ordered to be removed from any dental list in which it is now included. The name may not be included in future in any dental list unless the Tribunal or the Minister so directs.

THE SHEFFIELD DENTAL SCHOOL

OPENING OF THE NEW CHARLES CLIFFORD DENTAL HOSPITAL

THE story of the Sheffield Dental School begins on November 24, 1882, when two far-sighted dental practitioners, Mr. W. F. Brindley and Mr. J. L. F. J. Pike, called a meeting of all the dental licentiates in Sheffield. At this meeting, a Society of Licentiates was formed, and the proposal to form a school was discussed. Meetings took place during the next three years. By 1885, practical obstacles were such that the establishment of a school in Sheffield was remote. One definite step had, however, been achieved. It had been ascertained that the Council of the Medical School was in a position to appoint dental lecturers in connexion with the Medical Department of what was then Firth College. The financial aspect was one of the chief problems. At this time, other Medical Schools had already established dental departments, of which London, Birmingham, Liverpool, and Glasgow may be mentioned. In 1892 fresh efforts were made in the form of a direct approach to the Sheffield Local Infirmary, but this came to naught. In the same year, Mr. Frank Harrison proposed a scheme for a full working department at the Sheffield Public Hospital in West Street, which later became the Sheffield Royal Hospital. The Medical Staff here were prepared to co-operate in a generous manner.



The opening of the Charles Clifford Dental Hospital: Mr. A. Ballard, beside the Duchess of Gloucester, delivers the opening speech.

In 1898 three lecturers were appointed: Mr. F. Mordaunt (Dental Anatomy and Physiology), Mr. J. Lee Pike (Dental Prosthetics), and Mr. J. S. Allen (Dental Surgery and Pathology). The department was recognized by the Licensing bodies of the time. The L.D.S. diploma of Sheffield University was introduced about 1919, i.e., fourteen years after the University received its Charter. Mr. R. O. Warner, who is still a regular attender at functions of the Dental School, was the first conjoint student to qualify. Mr. D. Walker was the first Sheffield L.D.S. and qualified in 1923. The first degree of Bachelor of Dental Surgery was awarded in 1934, and the first Master of Dental Surgery in 1950.

Between 1919 and 1922, with the acquisition of premises for the teaching of Dental Prosthetics in the University at Western Bank, the school became a department of the Medical Faculty of the University. The pre-clinical and other general subjects were taken in the Faculties of Science and Medicine. In 1929, a grant from the Dental Board of the United Kingdom enabled modest extensions of the mechanics laboratories to be made.

In 1934 Sir Charles Clifford became interested in the Dental School and gave a house and funds for the establishment of a separate dental hospital. In 1935 the University created a Chair of Dental Surgery and appointed Professor G. L. Roberts as Professor of Dental Surgery and Director of Dental Studies.

Professor Roberts, who at the time of his appointment was one of the youngest professors in the country, had previously been tutor to the Dental School in Birmingham. Graduating M.B., Ch.B., at Liverpool in 1927, he took his dental degree in 1928. Shortly afterwards, he was appointed clinical tutor in

Dental Surgery at Leeds University. In 1947 Professor Roberts was elected a Fellow in Dental Surgery of the Royal College of Surgeons.

In 1936 further improvements were made in the premises of the Department of Prosthetics at the University.

Also in this year, plans were laid for the building of a new general teaching hospital centre, including a new dental hospital. In this year Sir Charles Clifford died. The war delayed the progress of the building plans. After the war, work went ahead on the academic side with a substantial increase in the academic dental staff, and the nucleus of the main departments was formed.

The first senior lectureship in dental prosthetics was created in 1946. In 1951 the foundation stone of the Charles Clifford Dental Hospital was laid by Mr. H. A. Marquand, M.A., D.Sc., M.P., who was then Minister of Health.

THE OPENING CEREMONY

Thursday, October 29, 1953

The opening ceremony took place in a marquee erected in the car park adjacent to the hospital. A large and distinguished company was present, representing most of the Universities and Dental Schools in the country as well as other interested bodies. Dr. E. W. Fish, Chairman of the Dental Board, was among the distinguished guests.

The platform party included Her Royal Highness the Duchess of Gloucester, Mr. A. Ballard, Chairman of the Board of Governors of the United Sheffield Hospitals, Dr. J. M. Whittaker, Vice-Chancellor of Sheffield University, Professor Roberts, Director of Dental Studies, Mr. R. G. Gwynne, Chairman of the Dental Advisory Committee, The Right Reverend Leslie Stannard Hunter, Lord Bishop of Sheffield, The Lord Mayor of Sheffield (Councillor Oliver S. Holmes, J.P.), and the Master Cutler (Mr. R. L. Walsh).

The proceedings were opened by the presentation of a bouquet to Her Royal Highness by Miss K. M. Chappell, the most junior dental nursing trainee. Mr. A. Ballard then gave a brief résumé of the plans for the development of the hospital services in the city, the present hospital being the first building to be completed under the scheme. He recalled the visit of Her Royal Highness in 1938, to launch the Million Pound Appeal Fund of the United Sheffield Hospitals. Mr. Ballard also spoke of the energy and foresight

Her Royal Highness the Duchess of Gloucester being shown round the hospital by Professor G. L. Roberts, the Director of Dental Studies.

of Professor G. L. Roberts, who had been the outstanding personality in the work which lay behind the building of the hospital. Then followed a short address by Her Royal Highness, who declared the hospital open. The Lord Bishop of Sheffield gave the Dedicatory Prayer. Professor G. L. Roberts and the Master Cutler, on behalf of the United Sheffield Hospitals and the City of Sheffield, expressed thanks to the Duchess and to all who had taken part in the planning and building of what was one of the finest dental hospitals in the country.

Mr. W. A. Guttridge, the Architect, presented Her Royal Highness with a case containing a pair of scissors.

After the opening ceremony, Her Royal Highness and members of the platform party

inspected the hospital. After tea, guests were invited to tour the hospital.

DESCRIPTION OF BUILDING

This is the first new hospital of its kind to be built in this country since before the second world war. It will serve a population of more than 600,000 in Sheffield and adjoining areas. The hospital cost about £200,000 to build and equip and has been financed as a national priority from the National Capital Development Fund for the Hospital Services controlled by the Ministry of Health and the Treasury. It forms part of the new general teaching hospital for Sheffield, which will eventually be built on an adjoining site. Work began on the Dental Hospital in October, 1950. The accommodation and facilities provided at the new dental hospital are amongst the finest in the country and can allow for an annual intake of approximately 50 students—the number recommended by the Teviot Committee in its report, in 1946, upon Dental Schools and Training. The hospital will permit the expansion of the Sheffield Dental School and enable the United Sheffield Hospitals and the University to play their full part in the training of the future dental manpower.

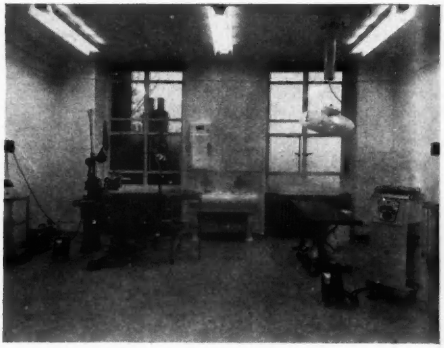
The hospital consists of three floors above ground and a lower ground floor.

Lower Ground Floor.—The students' locker room, male and female common rooms, canteen, maintenance workshop, photographic dark room, and a research laboratory are situated on this floor, together with the boiler room and storage accommodation.

Ground Floor.—The ground floor is devoted mainly to non-treatment activities and includes a modern lecture theatre, seating about 100 students. The histological laboratory, with its own rooms for staff and technicians, is situated on this floor. In addition, there is an operative technique teaching room, a museum and library, and administrative offices, these including rooms for the Superintendent and the Professor and their respective secretarial staffs. On this floor also is a common room for the senior staff, and the porter's office. The spacious entrance hall is a feature of this floor.

First Floor.—The first floor is the main treatment floor, in the centre of which is a large waiting hall and open registration office. The seating accommodation is of unusual type and consists of cinema seating. The chairs have sorbo-type seating covered in green leather cloth and are constructed in units of 2, 3, or 4, thereby allowing for mobility and rearrangement, as required. Various departments lead off from the central hall and include the Orthodontic Department, the Prosthetic Department, General Anæsthetic Room, Oral Surgery Theatre, and a Local Anæsthetic Department. The anæsthetic gases, nitrous oxide and oxygen supplies to the theatre and

The Histology Laboratory with lecturers' and technicians' rooms.



The Oral Surgery Theatre. (The entry of the piped anæsthetic gases can be seen.)

general anæsthetic room, are piped from an automatic unit which is outside the building. An Examination Room, X-ray and Photographic Rooms, Recovery Rooms, and offices are also situated on this floor.

Top Floor.—The whole of the top floor is devoted to the conservative restoration of teeth and periodontal work. There are 40 dental chairs with accompanying units and cabinets. Around the periphery of the floor are seven separate cubicles and a demonstration room. Each is equipped as a separate surgery, with different types of units, so that the student will be fully conversant with the various commercial patterns when he goes into practice. In addition, dispensary, recording accommodation, together with auxiliary laboratories, are provided.

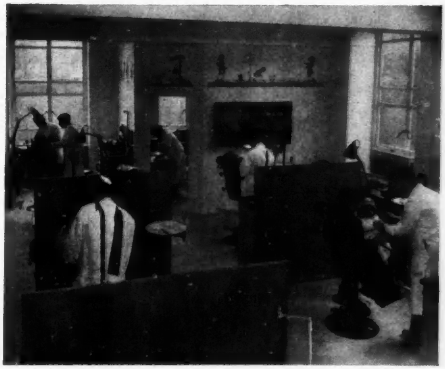
DEPARTMENTS

The Dental School has certain major departments, most of which are clinical, and are therefore situated in the Dental Hospital. The exceptions are the departments of Prosthetics and Oral Pathology, which have laboratories in both the University and the hospital. The pre-clinical subjects and general pathology and bacteriology are taught in the departments of the Medical School. The following is a brief outline of the establishment and work of the departments.

Department of Dental Surgery.—Professor G. L. Roberts is Professor of Dental Surgery and also Director of Dental Studies. The department has two full-time lecturers, an assistant lecturer, a part-time lecturer, and an honorary demonstrator. The Professor is an honorary consultant to the United Sheffield Hospitals, and the lecturers hold honorary senior dental officer appointments. The full-time dental consultant to the Sheffield Plastic and Maxillo-facial Unit is honorary lecturer in maxillo-facial surgery. There is also a lecturer in preventive dentistry who holds a dual appointment in preventive dentistry and dental anatomy. The department covers the academic course and hospital services in minor oral surgery and operative dental surgery.

On the hospital side there is a senior dental officer who is chief assistant to the Professor. He is responsible for much of the oral surgery and the local and general anæsthetic departments. The establishment also consists of a senior registrar and house surgeons. The visiting part-time clinical teachers consist of two consultants and four senior hospital dental officers.

Department of Orthodontics.—This department is housed in a separate clinical suite on the first floor of the dental hospital. The staff consists of a lecturer, one assistant lecturer, a part-time senior registrar, and orthodontic technicians. The lecturer is an honorary senior hospital officer and also consulting orthodontist to the Sheffield and Rotherham Education Authorities.



The Orthodontic Department with lecturer's demonstration room. (Note that each chair has its own working bench with sink.)

Department of Prosthetics.—The department of Prosthetics has a large laboratory in the main University buildings and also a self-contained clinical suite in the hospital. The department is in charge of a senior lecturer who is also an honorary consultant to the United Sheffield Hospitals. The remainder of the staff consists of a full-time lecturer, a technical instructor, and technicians. The students take their early mechanical training in the University laboratory where also the research of the department is carried out.

Readers will know that it was in this department that Professor J. Osborne, before his appointment at Birmingham, carried out his

researches on the acrylic resins and wrote his text-book, both of which gained him an international reputation.

Department of Dental and Oral Pathology.—This department has a well-equipped University research and teaching laboratory, temporarily situated on the site of what will be a new general teaching hospital. In addition, there are the histological laboratories at the Charles Clifford Dental Hospital. The department is in charge of a senior lecturer who is also an honorary consultant to the United Sheffield Hospitals.

The Prosthetic Department. (The door leads into the laboratory.)

The research laboratory staff includes a full-time research assistant, a chief and other technicians.

The hospital laboratories have their own technical staff and are chiefly concerned with surgical diagnosis and the preparation of material for teaching and research.

It is appropriate to mention here two outstanding personalities who were members of the University and associated with the Dental School. Lady May Mellanby, as also her illustrious husband, Sir Edward Mellanby, did much of her pioneering work in Sheffield. Dr. J. D. King, who worked with Lady Mellanby, obtained the first Ph.D. of the Dental School. He was later appointed Director of the Dental Research Unit of the Medical Research Council. His death last year was a great loss to the dental profession.

Department of Oral Anatomy.—This department is housed in the laboratories at the Dental Hospital and is under the general direction of the senior lecturer in Dental Pathology. The staff consists of a lecturer who is also a part-time lecturer in preventive dentistry. There is also an honorary lecturer. The technical staff is the same for both anatomy and pathology.

Conservation Floor. (Three of the side cubicles can be seen.)

General.—Besides the teaching and routine work of the departments, investigations on various subjects of interest are being carried out. In addition, some of the departments have organized research programmes, details of which are published in the handbook of Scientific Research in British Universities, compiled by the British Council.

The photographs were taken by the Department of Medical Photography, United Sheffield Hospitals.

J. J. H.

INSTITUTE OF BRITISH SURGICAL TECHNICIANS (INC.) (Dental Section)

A LECTURE will be given by Mr. C. T. Youles, L.I.B.S.T., on "Immediate Dentures—Laboratory Procedure" on Tuesday, Jan. 19, 1954, at 6.30 p.m., at the Eastman Dental Hospital, Gray's Inn Road, W.C.1.

Tickets from the Institute or through members.

THE PROCEEDINGS OF THE BRITISH SOCIETY OF PERIODONTOLOGY

President: A. FRANK STAMMERS, M.D.S.

Hon. Secretary: H. THOMSON, L.D.S. R.F.P.S. Glasg., H.D.D. R.C.S. Edin.
53, Portland Place, London, W.1.

Vol. IV, No. 3 January, 1954

THE EXPERIMENTAL INVESTIGATION OF PERIODONTAL DISEASE IN THE FERRET AND IN MAN, WITH SPECIAL REFERENCE TO CALCULUS FORMATION*

By the late **J. D. KING**, Ph.D., D.Sc., F.D.S.

FIRST, I want to make it quite clear that most of the work on which this paper is based has already been published. But some of the experimental findings have appeared in scientific journals which are not always accessible to the dental practitioner. I think this is one of the reasons why your secretary asked me to talk about calculus, but I am well aware that his main reason was to give *you* the chance of criticizing certain of my statements with which you disagree. At the same time this meeting will give me the chance of answering criticism in more detail than would otherwise be possible.

I am therefore grateful to the Society for inviting me here to-night. I have been asked to be provocative and I hope that my remarks will arouse an interesting—perhaps even a heated—discussion. If, at times, I seem to stray away from the precise title of this paper, it will be for the purpose of showing how the calculus problem may trespass on territories normally the preserve of those engaged in caries and other research. The late G. K. Chesterton provided the classic example of absent-mindedness. He was once travelling to some distant literary function when he sent this telegram to his wife: "Am in Birmingham. Where ought I to be?" Well, at least I know where I am and what I'm here for; so if, as I say, I appear to wander off the subject, it will be quite intentional.

The first part of the paper will deal with experiments on animals, the obvious advantages of which lie not only in the proper control which can be exercised over their diet, environment, and general health—all factors which, in man, are always difficult and usually impossible to regulate—but also in our ability to culture, section, and examine chemically or physically the material at any phase of calculus formation. Secondly, although our studies are only at an early stage, I shall mention the possible application of some of these animal findings to man. And, finally, I want to give you some indication of the direction our current work is taking and of the many difficulties which must be overcome before our goal is reached.

CALCULUS IN EXPERIMENTAL ANIMALS

a. **Clinical Data.**—My interest in dental disease became crystallized in 1932, when I began whole-time research at the University Field Laboratories, Sheffield. For some years I was largely engaged with the nutritional aspect of various clinical and laboratory problems, with special reference to vitamins A, D, and B_2 complex. At the same time little attention was paid to local factors in the mouth, such as food impaction and calculus, which so often complicated the nutritional picture. For example, in the later phases of

* This paper was to have been presented to the Society on Dec. 10, 1952, two weeks following the author's untimely death.

vitamin-A deficiency in rats, keratinization of the subgingival epithelium occurred and was associated with calculus formation; no calculus occurred in the +A controls. The possible significance of this observation was not fully appreciated at the time (1939) but, as you will hear later, it may have an important bearing on the nature of the substrate on which calculus first forms.

Then, early in 1942, I chanced to examine three ferrets previously used for other purposes at the National Institute for Medical Research. In one I noted conditions simulating chronic periodontal disease in man. I was so struck by this resemblance that a survey was made of the stock colony of ferrets at the Institute's farm; some 70 per cent of animals were found to be suffering from the same lesions in varying degree. But apart from the mouth, affected ferrets on adequate diets showed no other defects, nor was there any clinical or post-mortem evidence of general ill health. It was therefore decided to make a full-scale investigation of the disease, in the hope that the ferret lesions might provide information concerning their apparent counterpart in man.

The ferret, which is the albino form of the polecat, is a carnivore of the same main species as bears, racoons, stoats, and weasels. With the exception of the upper first and lower second molars, all of its teeth are of secodont form and have a scissors-like action during mastication. They are therefore similar in function to the incisor and canine teeth in man and occlude in a similar manner. The salivary glands comprise three main groups—parotid and infra-orbital in the maxilla, and retromolar in the mandible.

It was found that the periodontal lesions arose in the gum close to the openings of the salivary ducts—namely, on the labial side of the upper and the lingual side of the lower carnassials—and were accompanied by deposition of calculus on the adjacent teeth. As the disease progressed, the calculus increased in amount and the gingivæ became more swollen and hæmorrhagic. Later phases included gingival recession, resorption of alveolar bone, cavitation of the cementum and even dentine of the tooth-roots (sometimes with calcific pulp reactions), periodontal abscesses, and loosening of the teeth. Through all these stages, no extra-oral changes were to be seen.

The aetiology of the conditions still remained obscure, but a suspicion that diet played some part arose from two suggestive observations. First, the disease had not been previously recognized in ferrets; secondly, it seemed to have appeared with war-time modification of the animals' rations, at least in our laboratories. An intensive dietary study was then begun, with special reference to the meat, cereal, mineral, and vitamin supplies. It was found, however, that reinforcement of the diet—with vitamins A, D, B-complex, and C; with extra meat, raw or cooked; with altered or reduced cereal content; with fresh raw milk, whole milk powder, or separated milk powder; or with fresh liver—all failed to prevent tartar deposition and gum disease. Changing the *p*H of the drinking water to the acid or to the alkaline side and alteration of the dietary Ca–P ratio were also of no avail.

Attention was next focused on a different aspect of the diet—namely, on the manner in which the meat was fed to the ferrets. Before supplies were restricted, in addition to a daily stock ration of chopped meat per animal, parts of horse or cow carcases—including both muscle and skeleton—were given, and periodontal disease was apparently unknown in ferrets. With the war-time need for bone-meal as a fertilizer, owing to shortage of phosphates and increased arable acreage, the amount of bone obtainable had become much reduced—and at the same time the ferret disease had become recognized. Were these occurrences fortuitous, or were they somehow related?

I had already noted that meat itself failed to prevent tartar or gingivitis, but it seemed possible that some constituent of bone, other than its mineral content, might provide a clue. It was then found that uncleaned bone—that is, with periosteum and some muscle and tendon attached—when fed to the ferrets irrespective of their other food, not only prevented tartar deposition and gum disease but even eradicated these conditions if they were allowed to develop. These prophylactic and

curative effects were not due to any chemical properties of the bone, as shown by the fact that periosteum, red or yellow bone-marrow, or powdered or macerated whole bone plus attachments, all failed to prevent the lesions. In fact, the animals gnawed off any meat attached to their dietary bone but ate none of the bone itself; if the bone was stripped of all attachments the animals would have nothing to do with it and then developed calculus and gingivitis. It seemed, therefore, that the prophylactic and curative properties of bone lay in the meat attached to it which the ferrets were induced to gnaw off and, in doing so, provided sufficient friction of tooth against dietary bone to prevent tartar deposition.

b. **Histological Data.**—So far so good, but the significance of these animal findings in relation to periodontal disease in man must obviously depend on the degree of similarity of the oral tissues in the two species. At the same time, therefore, it was necessary to make a detailed microscopical study of the ferret's tissues in health and disease. The results were based not only on serial sections of gum, bone, and teeth *in situ*, but also on the vascular pattern *in vivo* and post mortem viewed and photographed by a specially designed capillary microscope. They showed quite clearly that the carnassial region of the ferret in health or disease differed in no essential respect from the incisor region of man.

The *earlier phases of the ferret disease* were comprised of certain characteristic events, all of which were inter-related:—

1. Deposition of calculus on the teeth.
2. Impingement of calculus on the gingival crest.
3. Loss of the keratinous covering of the gum crest and splitting of the so-called epithelial attachment, with pocket formation.
4. Proliferation of the gingival epithelium into the corium and later along the cementum.
5. Dilatation of the blood-vessels of the corium.
6. Loss of connective-tissue fibres, cells, and vessels, and their replacement by proliferating epithelium.
7. Infiltration of the gum by leucocytes.
8. Eversion of the diseased gum in an attempt to eliminate the pocket—a kind of natural gingivectomy.

Calculus arose on those surfaces of the teeth which were relatively sheltered from the friction of mastication and were, at the same time, nearest to the openings of the salivary ducts. In the upper jaw such regions were the labial intercuspal groove of the upper fourth premolar, and in the lower jaw the lingual intercuspal groove of the first molar. It is important to note that these same sheltered grooves in which calculus was first seen were those retaining relatively large amounts of Nasmyth's membrane. This keratin-like membrane appeared to comprise the substrate in or on which calculus was first formed. With impingement of calculus on the gum crest, the accretions were laid down in the degenerating gum epithelium of the pocket wall, and later in the periodontal membrane and on the surface of the cementum. Although a large number of bacteria were found in calculus itself, the associated periodontal tissues were not invaded in the proper sense of the term—gingival ulceration and bone resorption were effected by cellular degeneration and giant-cell activity.

But there is one phenomenon which is often forgotten or unnoticed—namely, the occurrence of two types of cavities in the tooth roots. One of these seems to arise in close association with the proliferation of calculus along the cementum; the other type of cavity, although probably related to calculus, occurs much farther down the root, with no obvious connexion. We do not know how such cavities are actually formed. We do know that they can penetrate both cementum and dentine and so provide a ready route for invading calculus. Moreover, they constitute a real menace to the periodontal tissues, since deep dental penetration is usually associated with a surface opening so small as to preclude removal of their contained calculus by frictional or scaling methods. In such cases a nidus of calculus must remain around which further accretions form.

All of the conditions I have mentioned are those which arise in ferrets not given access to

dietary bone-gnawing and their analogues are to be seen in the human subject. Except in the later stages, they can be simply and effectively prevented in the animals by bone-gnawing, which will also cure the established lesion by removing both the causative calculus and the necrotic gingivæ. The essential mechanism is concerned with the friction of tooth and gum against dietary bone.

Recurrence of Calculus.—If, after curing the ferret disease by bone therapy, the dietary bone was withdrawn, new calculus soon formed—indeed, the rate of re-formation was often much faster than before. This observation led me to test the effects of repeated scaling of the ferrets' teeth. In one series of experiments the teeth were scaled once weekly for 4 months. After 3 months visible amounts of tartar began to form on the teeth between one scaling and the next—that is, *within* 7 *days*.

Chemical Composition and Physical Structure of Ferret Calculus.—Although, then, it is clear that both clinically and histologically the ferret disease can be said to be comparable to human lesions due to calculus, for the study of calculus itself it is necessary to know whether or not the animal material has a chemical composition and physical structure similar to the human material. This has now been established by our biochemist, Dr. Rowles, and by the X-ray diffraction studies of Dr. Thewlis and Dr. Little at Harwell. The deposits contained considerable amounts of calcium and orthophosphate, with a Ca–P ratio comparable to those of tricalcium phosphate and apatite. The physical methods disclose that both ferret and human material have a physical structure strongly resembling that of hydroxyapatite, the X-ray photographs being indistinguishable by eye from those of bone and dentine.

It is clear, therefore, that we now possess an experimental animal in which that form of periodontal disease due to calculus can be induced and prevented at will and whose various stages can be studied in detail. We now know many of the clinical and histological tissue reactions which will occur as health gives way to disease; what is more, we are able to follow these changes in an animal whose oral lesions are due to calculus alone and are uncomplicated by systemic factors. This, I think, is the first important step in our particular problem.

Table I.—Incidence of Dental Calculus in Schoolchildren

Date of Survey	District	Age of Children (Years)	No. of Children Examined	Children with Calculus
				Percentage
1937*	Isle of Lewis (rural)	11–15	413	59·6–71·3
	,, ,, (urban)	11–15	74	86·0–88·2
1938†	West Ross-shire (rural)	11–15	31	66·7–70·0
	London S.E.	11–15	140	58·5–70·7
	Sheffield	11–15	108	56·2–58·3
1948†	Trinidad (urban)	12–14	186	86·6
	,, (non-cane rural)	12–14	120	80·0
	,, (cane rural)	12–14	100	82·2
	British Guiana (non-cane rural)	12–14	40	92·5
	,, ,, (cane rural)	12–14	60	95·0

* Whole mouth examined. Lower incidence values refer to children of 11–13 years, higher values to those of 13–15 years. (King, 1940.)

† Examinations confined to incisor and canine regions (King and Martin, 1951).

CALCULUS IN MAN

I would now like to discuss briefly the occurrence and sequelæ of calculus in man.

Incidence.—This is best considered in children or adolescents. *Table I* shows the figures in two surveys of children of 11–14 years.

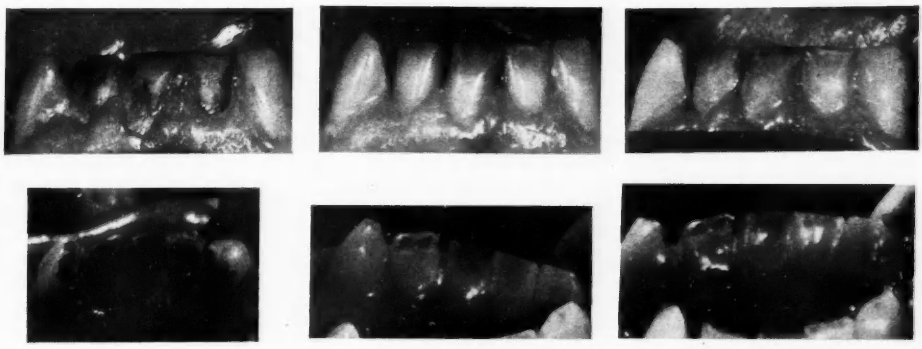
Unlike caries, therefore, the incidence of periodontal disease and of calculus is as high,

and sometimes higher, in remote less civilized communities.

Association with Gum Disease.—In these and various other surveys, I have always found a high degree of association between calculus and gingivitis. For example, the X^2 test on data for 2,996 incisor and canine regions in the West Indies survey gave $P < \cdot 0000001$, giving a high degree of association. In view of the ferret and other animal studies, it is safe to infer that such an association in turn indicates that calculus is the main causative factor of some 80–90 per cent or more of gum lesions. This well shows the magnitude of our problem.

Control of Calculus.—In the ferret, as you have seen, calculus can be prevented and controlled by the friction of bone-gnawing. In man, however, we have no means of applying *sufficient* friction to those surfaces of the teeth where tartar is most common and its periodontal sequelæ most severe—namely, the lingual aspect of the lower incisors, the labial aspects of the upper first molars and the approximal surfaces of the teeth in both regions. And so we must rely on the mechanical removal of calculus by scaling at regular and frequent intervals.

But, as in the ferret, there is a tendency for the rate of re-deposition of tartar to increase after scaling. This was noted first in 12 institutional boys in 1947. Their incisors and canines were carefully scaled, but within 3–4 weeks new hard tartar was found on the incisor teeth and by 8 weeks the amounts of yellowish-brown hard calculus were as great or greater than before scaling. In 11 other boys, given canned sugar-cane to gnaw, a similar but lesser re-disposition was found. Later in the same year a still more rapid recurrence of calculus after scaling *and polishing* was noted in 3 hospital out-patients within 1–3 weeks (*Fig.* 1).



A B C

Fig. 1.—The re-deposition of tartar after scaling. Lower incisor teeth : A, Before scaling (Oct. 13) ; Scaled on Oct. 17 ; B, One week after scaling (Oct. 24) ; C, Three weeks later (Nov. 7).

At the present time Mr. Trotter and I are studying this phenomenon more fully.

CURRENT AND FUTURE INVESTIGATIONS

"Substrates" for Calculus.—We now know that, in both animals and man, Nasmyth's membrane is one of the tissues most favoured by tartar deposits. In ferrets, hamsters, and man the dental grooves nearest to the openings of salivary ducts are the commonest sites, and these same regions contain and retain relatively large amounts of Nasmyth's membrane. When pockets are formed, by disease or by injury from dental instruments, progressively increasing exposure and consequent keratinization of the subgingival epithelium occurs, thus providing a substrate for further calculus deposition. Again, we have found that in animals and in man impacted food particles provide another nidus around which tartar can form. Thirdly, as we all know, calculus will form on acrylic or vulcanite dentures, and here there may be an intermediate

substrate in the form of salivary mucin, food debris, etc., especially on dentures less highly polished. One of the possible methods of attacking the problem may be to prevent deposits by chemical or other treatment of the keratinous substrates. In the other two cases good mouth hygiene should suffice.

Fig. 2.—Showing calculus invading the root substance.

Initial Site of Coronal Calculus.—In the ordinary course of events, as I have said, the first and heaviest deposits occur on those parts of the enamel nearest to the openings of the salivary ducts and where, at the same time, Nasmyth's membrane is most sheltered from friction and is thus retained in greatest amount. This holds true for animals and man. In the human permanent dentition such regions are the labial aspects of the first upper molars and, in particular, the lingual aspects of the lower incisors. Referring to the lower incisors, in 1945, I suggested that individual differences in susceptibility to calculus might depend in part on tooth morphology—heavy deposits being found on teeth with deep cingular and other grooves, and little or none on teeth with smooth, ungrooved lingual surfaces. Involvement of other regions generally occurs by simple extension of the original accretions along or just below the gum margin, but tartar may also form in other areas should gum pocketing arise from food impaction, denture clasps, etc.

Subgingival Calculus.—But when calculus has begun to form on the cementum we are in real trouble. In both animals and man we have found that in some manner the calculus invades or feeds on the root substance (both cementum and dentine) by way of channels into the root too small to allow the passage of scalers, probes, or broaches (*Fig.* 2). In such cases, however careful the scaling and polishing, some calculus always remains to form the basis for further deposits. This phenomenon, together with the almost universal damage to the gingival crest during scaling—which causes further epithelial keratinization—may account for the relatively rapid recurrence of tartar after scaling. Here the problem may be solved only by the basic knowledge of how tartar is formed, no matter what the substrate. One of the ways in which this is being tackled is by a detailed study of the chemistry, including enzyme chemistry, of calculus and saliva. For this purpose both ferrets and human subjects are being used and special attention is being paid to any chemical differences which may be present during the earlier and later phases of calculus formation. In the animals, too, dietary factors are being studied, and we already have evidence that the nature of the diet is reflected in the initial rate of tartar formation. In addition, various experiments are being made on the production of calcified material *in vitro*, under conditions approaching those found in the human mouth.

Other methods of investigation include the experimental production of calculus on human dentures and on tooth slices attached to such dentures.

Micro-organisms.—In both the ferret and man a start has been made on identifying the bacteria which may be involved in the

formation of tartar. Here there are four primary questions to be answered: (1) Are there any specific organisms or groups of organisms which play a *direct* part in laying down calcified material? (2) Are organisms in the calculus-forming process of importance only as the source of a tooth-adherent organic matrix in which lime salts are deposited by other means? (3) What part, if any, do bacterial enzymes such as alkaline phosphatase play in the process? (4) Is calculus due to a combination of any of these processes? At present all we can say is that in our laboratories the following organisms are regularly found in cultures of ferret calculus: aerobic actinomyces, diphtheroids, Gram-positive micrococci, and Gram-negative rods. Further work on this aspect of the problem has had to be deferred for the time being.

Clinical Studies.—These are at present being confined to observations on the rate of recurrence of calculus following scaling, but we are also including chemical and X-ray diffraction analysis of the material at different stages for comparison with that in the ferret.

CONCLUSION

I have tried to cover a lot of ground in as short a time as possible. Indeed the material is mainly condensed from about fifteen published papers. I hope, therefore, that I have not confused the various issues too much.

Some of you may think that while some of the findings are new, others were known long ago. But I believe that, by using the combined experimental and clinical approach, we have at least given the whole problem the scientific foundation so lacking in the past and so essential to its future solution.

I am well aware that the research worker is expected to "explore every pocket" and "leave no calculus unturned" in his search for truth. I am also aware of the harsh criticism he should expect if he drops a brick in the unruffled waters of established clinical procedure. In this paper I have refrained from throwing obvious bricks, but hope that I have sustained the provocative note for which your secretary asked.

ADDENDUM

Analyses of calculus scrapings shown in *Fig.* 1.

Initial calculus, scaled Oct. 17: Acid-soluble calcium, 26·6 per cent.; Acid-soluble phosphorus, 14·2 per cent.; Ca-P ratio, 1 : 88.

Calculus re-formed in 4-week period, scaled Nov. 13: Acid-soluble calcium, 21·9 per cent.; Acid-soluble phosphorus, 12·3 per cent.; Ca-P ratio, 1:78.

ART AND DENTISTRY

Invitation to Paris Salon

THE Twenty-sixth Exhibition of Paintings by Doctors, Dentists, Pharmacists, and Veterinary Surgeons (Le 26° Salon des Médecines, Dentistes, Pharmaciens et Vétérinaires) will be held in Paris from March 7 to 21, 1954, at the Musée d'Art Moderne (France's National Art Gallery), 11 Avenue du Président Wilson.

As in past years, it will group sections for paintings, sculptures, photography, and applied decorative art.

After the great success the Salon has enjoyed it is desired to bring the 1954 Exhibition up to an even higher standard.

Colleagues are invited to send their works of art, vacation, and pleasure to this Paris Exhibition.

The Minister of Public Health will again reward the laureates who will receive medals.

Although the Salon is not an international one, in view of the Franco-British Cultural Relations Campaign, contributions from the British Dental Profession are cordially invited.

Works, etc., should not be sent direct to the Salon, but should be addressed to Messrs. Davies Turner, Ltd., 4, Lower Belgrave Street, S.W.1., who will forward to Paris. Each object must bear a label giving full particulars: name, address, qualifications (Dr., Dent., Pharm., Vet. Surg., etc.) and title of the exhibit. Those wishing to participate should inform the secretary: Dr. Malet, 67, Avenue Pierre-Larousse, Malakoff (Seine), France (Tel.: ALEsia 07 09), not later than Feb. 10, 1954, with full particulars as above, so that they may be included in the special de luxe catalogue.

BOOK REVIEW

PATHOLOGY FOR STUDENTS OF DENTISTRY. By GEORGE L. MONTGOMERY, T.D., M.D., Ph.D., F.R.A.P.S.(G.), F.R.S.E., St. Mungo (Notman) Professor of Pathology, University of Glasgow. $5\frac{1}{2} \times 8\frac{1}{2}$ in. Pp. 305 + viii, with 133 illustrations, and 8 coloured plates. 1953. Edinburgh: E. & S. Livingstone Ltd. 37s. 6d.

THIS is an orthodox and competent work, published in a volume pleasant to read and to handle. As a work for beginners, it cannot avoid being selective, dogmatic, and largely descriptive; the purely morbid anatomical viewpoint from which it is written would have benefited from fuller treatment of the humoral (e.g., complement-fixation) and chemical events in the pathology of the living, and tabulation might have been adopted more; the smoothness of the writing leaves less impression on the student mind. The chapters, at present separate, on inflammation of the chest, peptic ulceration, and the cardiovascular system might with advantage stand earlier as illustrations of the chapters on inflammation and on circulatory changes; the last six chapters, tucked away behind an excellent account of tumours, seem at present a detached and incomplete afterthought. Most of the illustrations are excellent: a few are too dark, a few (*Figs.* 77, 83) are too advanced, another (*Fig.* 85) would be better at a higher magnification, and *Plate IV* has been inverted in relation to its caption. Actinomycosis sits uneasily with tubercle and syphilis and would be better with the chronic purulent inflammations, whose aetiology merits fuller consideration, since persistent low-grade inflammations make up many of the clinical problems of the general practitioner; and a chapter on the general diseases of bone would be a valuable addition. Few statements which can be called inaccurate have been found, though the lymph-glands of syphilis do not seem happily described on pp. 71 and 293. The reviewer, although differing in his own teaching in certain matters of detail and emphasis, would be very pleased to think he could concentrate his material into such a compact form and sacrifice as little of importance as Professor Montgomery has; and at the same time by writing which maintains the dental students' interest in work that is not strictly of close personal importance to him in his future profession, this book has made it likely that he will gain full value from his general pathological studies. J. W. L.

WAVERLEY COMMITTEE MEETS

THE Forces Medical and Dental Services Committee, under the chairmanship of the Right Hon. Viscount Waverley, held its first preliminary meeting at the Ministry of Defence on Wednesday, Dec. 2. It met again on Friday, Dec. 11.

The Committee is charged with reviewing the arrangements for providing Medical and Dental Services for the Armed Forces at home and abroad in peace and war, and to make recommendations.

The composition of the Committee—announced in a written Parliamentary reply on Dec. 1, is:—

The Right Hon. Viscount Waverley (*Chairman*), Sir Harold Boldero, Mr. S. R. Dennison, Sir Thomas Gardiner, Sir Arthur Porritt, and General Sir James Steele.

Correspondence for the Committee should be addressed to its Secretary, Mr. E. P. Donaldson, Ministry of Defence, Storey's Gate, S.W.1.

SCOTTISH DENTAL ESTIMATES BOARD

New Members

THE Secretary of State has appointed Mr. J. McLean Foreman, L.D.S., and Mr. J. G. P. Stevenson, M.B.E,, J.P., to be part-time members of the Scottish Dental Estimates Board in place of Mr. Frank G. Mackenzie, L.D.S., and Mr. George Cruickshank, C.B.E.

Mr. MacKenzie and Mr. Cruickshank have served continuously on the Board since it was established in June, 1948, and are due to retire at the end of this year.

OFFICIAL SUPPLEMENT OF THE

SURGICAL INSTRUMENT MANUFACTURERS' ASSOCIATION (INC.)

DENTAL LABORATORIES SECTION

Chairman: E. G. EMMETT, F.I.B.S.T.

Administrative Offices: 6, HOLBORN VIADUCT, LONDON, E.C.1

Telephone: CITY 6031

Vol. III, No. 10 January, 1954

Editorial Committee: D. M. BEAUCHAMP; H. J. POTTER, F.I.B.S.T.

EDITORIAL

TWO separate articles in this issue mention prizes. During former years the rewards for good dental prostheses have been mainly the pleasure of making them, in much the same way as the reward for virtue is only virtue itself. It is interesting that following the recent offers in our own country of the Denny Cup and the Aspin Cup and Medal, for which dental technicians may compete, in connexion with the congress of the Italian association at Milan next April gold medals and substantial cash prizes are offered for fixed and removable prostheses.

Having regard to the long prizeless past, the comparatively sudden appearance of these phenomena, confirm in yet another different way the declaration of the American laboratories president at the Holborn Restaurant in 1952, that the dental technicians of the world are thinking alike.

We have yet no certain information as to who may compete, but we know that the Italian association, like that of Israel, includes both employers and employees. We may therefore assume that either class may enter, and as there is nothing more encouraging to the sponsors of a new and bold venture than to find an ample response, it is hoped that many entrants from this country will come forward.

The brilliant Italian arrangement to hold the congress concurrently with the International Milan Fair, in the same precincts, so as to avail themselves of the reductions of railway fares, to ensure a larger attendance, and to use space better adapted to the various exhibits, should make this a world-wide attraction to dental technicians.

The fifth annual dinner, general meeting, and exhibition offers a further opportunity for our members and friends, to join in a function at which they may support Vice-president G. E. Cross as he makes a presentation to his predecessor Mr. A. J. Grant in recognition of his many years of service, and honour our guests, among whom will be the well-known and respected figure of J. Hutchinson Cottrell, Esq., President of the Association of Dental Manufacturers and Traders, C. T. Youles, Esq., Chairman of the National Joint Council for the Craft of Dental Technician, and M. Jean Oosterbosch, late chief technician at the University of Liége, Vice-President of the Belgian Association, and Secretary of the Fédération Internationale de la Prothèse Dentaire.

Last year's new resolution for the establishment of cultural contacts with foreign laboratory associations has been only partly realized, representatives of France, Belgium, Italy, and Switzerland have been added to our personal acquaintance, and those of Norway, Sweden, and Holland to our correspondents. Adopting the same resolution this year, given the same progress, the year's end should see encouraging results.

DENTAL EDUCATION IN BIRMINGHAM

HAVING competed successfully for the Aspin Cup and Medal, and book prizes offered by Hawley and Yates, Midland Dental Manfg. Co., Dental Manfg. Co., S. S. White Co., Birmingham Education Committee, the Local Dental Committee, and U.S.D.A.W., winners Miss June Sale, and Messrs. Peter R. Martin, John Crump, and John Hartwright were presented with their prizes by Professor John Osborne at the College of Technology, Birmingham, on November 4.

An S.I.M.A. member, Mr. Denis Byng, who himself won book prizes as a result of his final examination, had donated the Byng Medal, which was won by the outstanding student of the year, Mr. Raymond Allen.

Mr. A. Gardiner, of Coventry, who represents the Birmingham branch on the main committee, thanked the Principal of the College Mr. J. Wilson, B.Sc., M.I.M.E., to whom he paid tribute for his helpfulness and interest in our craft, by his efficient methods. Mr. Gardiner made known his pride in being associated with the Birmingham district whose percentage of successes was the highest in the country, referred to the efforts S.I.M.A. members make to help students in any way, and announced that one of the prizes, £2 2s. 0d. in value, offered by the Birmingham branch, was won by Mr. Denis Broadley.

Thanks to Professor Osborne for his part in the proceedings were given by Mr. L. C. Darch, L.D.S. R.C.S.

INTERNATIONAL UNION OF DENTAL LABORATORIES

(*Report of Provisional Council Meeting in the Kongresshaus, Zürich, October* 11, 1953, *under the auspices of the Swiss Association of Dental Laboratories*)

THE session opened at 10.15 a.m. and there were present: M. Corrodi, *Swiss President*; M. Muller, *Swiss Secretary*, MM. Kitsman and Stemmle, *Swiss members*; M. Duvaudié, *French Association Vice-President*; Signor Gildo Martinazzi, *General Secretary of Sindacato Nationale Odontotecnici*; S. Baroffio, *Milan Branch Secretary of S.N.O.*; S. Vincenzo Vare, *Administrative Secretary of S.N.O.*; S. del Grossi, *Editor of Italian journal*; and M. Jean Oosterbosch, *Vice-President of Belgian Association, Secretary of International Union.*

M. Duvaudié excused his French colleagues who were not able to be present because of the late summons. M. Oosterbosch asked that M. Hutsebaut from Brussels be excused, and read a letter of apology from MM. Emmett, Spencer, and Beauchamp, Great Britain.

President Drouhin being absent, Signor Martinazzi was appointed as chairman.

MM. Corrodi and Muller welcomed the members of the committee in the name of their association, and apologized for not being able to cause the immediate adherence of the Swiss to the International Union, as the by-laws were still unknown to them, and their members had not been consulted.

Secretary's Report.—After excusing himself for not having been able to summon the members before the beginning of October, M. Oosterbosch furnished the explanation concerning the delay. Switzerland, said he, had been chosen as the country where would take place the first meeting of the provisional committee. It had been agreed that this meeting would take place in October, because a congress of our Swiss colleagues had been announced for this month. But information having come late he learned that the congress was that of the Swiss Dental Technicians' Association, and that there existed an important employer's association which was not included among the addresses of the Swiss organizations in his possession.

It was not until Sept. 11 that it was possible to be accurately informed on this subject; these circumstances together with a journey to England until Sept. 25, delayed the fixing of the date and place of meeting. He thanked M. Muller and his collaborators for being

willing to help make up for lost time, and arrange this meeting. He then read the verbatim report of the preliminary assembly of May 17, 1953, in Paris. This report was approved.

M. Corrodi put some questions concerning the purposes and organization of F.I.P.D. and the conditions required of a national association to become a member. M. Oosterbosch replied that employers' associations only are members, and that they keep the employers' character, when they gather in their midst employee elements. On this subject S. Vare gave information about the Italian body, and a discussion followed in which intervened Martinazzi, Vare, Muller, Kitsman, Baroffio, and Oosterbosch.

M. Duvaudié read a letter from M. Drouhin, absent because of a business appointment made many weeks before which he could not cancel. By this letter M. Drouhin excused himself not being able to be present, and sent his wishes for success of the work to be undertaken. He wished for a rapid increase of the effective strength of our group, and the adherence of the Swiss.

M. Duvaudié affirmed: (1) his faith in the future victory of our ideas, and reminded his hearers that we have in no way the intention of revolutionizing the dental world, and (2) the necessity of showing that we were organized and conscious of our responsibilities, in order to induce our respective governments to interest themselves in our position. He wished that very soon we may be able to study a plan of organization and professional formation, but that to-day we put ourselves in agreement on the principal questions so that the agenda of our next meeting be well prepared. The congress at Milan must be a success, we are bound therefore to prepare for success: our movement must expand itself, so that our profession may be recognized by the public authorities in all the countries of the world.

Milan Congress.—The general assembly of the F.I.P.D. was fixed for Saturday, April 24, 1954, and by an arrangement with the management of the International Milan Fair, the congress is to be held from April 25–28 in rooms in the same enclosure.

S. Martinazzi hoped for a large meeting, where everybody may speak, and where they be not too strict in admitting participants. He proposed the following agenda: Speech by president; speech by secretary; general discussion; separate delegates' discussion; renewal of general discussion for decision. For the working of the assembly interpretations, typing, etc., the Italian association will be responsible: they will devote one day or one day and a half to the general assembly.

The following dispositions were made in view of the ratification of the by-laws. Before their final approval the votes will be issued in the ratio of one to each country participant. After this approval the votes will be issued to the rate of the number of delegates foreseen in articles 12 and 13. These delegates will be asked to sign the adopted by-laws. The president will confer on everyone the right to speak, conformably to the powers conferred on him by article 12.

Signor Baroffio, having been entrusted with the organizing of the Milan Congress, was asked to make his statement. He declared that the task which had fallen to the lot of the Milan branch, and himself as secretary, did honour to his country; he understood the bearing of his task and the responsibility, and showed the importance of the coming congress. He distributed a suggested scheme of posters to be printed in Italian. S. Baroffio thought the congress ought to view two themes: (1) Fixed Prosthesis; (2) Removable Prosthesis. S. Nodari will be the principal reporter for fixed prosthesis, assisted by S. del Bianci: removable prosthesis will have as primary reporter S. Romagnoli, assisted by S. Friulzi. The reports will be worded in various languages.

A novel feature of the congress of Milan will be the organizing of a competition. All the congressists who ask in time will receive a plastic model. They will have to make to this model two prostheses, one fixed, the other removable. An international jury will be appointed. There will be a prize for each style. These prizes will be a gold medal and a sum of 50,000 lire (approx. £31) for each of the two types of prosthesis; there will also be two second prizes of 35,000 lire (approx. £22),

and two third prizes of 15,000 lire (approx. £9), plus materials offered by the dental depots. Subjects at the free choice of members may also be propounded.

S. Baroffio has also foreseen a historic exhibition of dental prosthesis: articles of great historic interest will be lent by the museums and schools. There will also be an exhibition of dental materials and equipment, and commercial demonstrations by depots. He asked whether dental surgeons should be invited to the congress, either as lecturers or listeners. The committee decided in the affirmative. In addition to these displays of a scientific character, it was suggested inviting well-known personalities, and arranging recreative items such as visits in the town. He will make appeal to the press, and all will be done to assure large propaganda for the congress.

The expenses of the congress will be paid by the Italian association.

S. Baroffio made appeal for the addresses of the associations of all countries. He asked that in each country a committee will charge itself to diffuse all news relative to the Milan congress, and put itself in communication with the Milan branch so as to obtain information concerning lodging and travelling.

M. Muller remarked that the programme established by Sr. Baroffio made no allusion to the work of the F.I.P.D.

M. Oosterbosch explained that the congress ought to be envisaged under two aspects. "The congress organized by our Italian friends is a cultural and scientific congress which concerns principally the Milan organizers. The other aspect is the professional character in the legal sense of that word. It is in this regard that the F.I.P.D. may come in, taking advantage of the Milan Congress, and the hospitality offered by the Italians. All which concerns the congress has been so very well explained by S. Baroffio, whom the committee approves and supports. The other side of the question, the general assembly of F.I.P.D., will be discussed this afternoon, seeing that the time has gone."

M. Corrodi approved the programme of S. Baroffio, and assured him of the support of the Swiss. He asked to be better instructed on the F.I.P.D., in view of the affiliation of the Swiss.

It was decided that M. Oosterbosch, in agreement with M. Drouhin, will fix the agenda details, forecast rules for the assembly, and summon the greatest number of associations.

M. Muller undertook the work of translating the by-laws into the German language.

As M. Corrodi went to address the dental technicians, the F.I.P.D. committee requested him to convey their good wishes. M. Corrodi agreed to do this.

Afternoon Meeting, 3.50 *p.m.*

Organization of Future Secretaryship. — Report of M. Perrot (absent and excused): Definition of the work which awaits the future secretary, necessitates the stating, at least in outline, of the principle activities of F.I.P.D. The work will be moderate or severe, depending on the impulse given to these activities. We see them set down under four headings:—

1. Edition of an international professional journal as foreseen at the Paris meeting last May. In our opinion it is the task which must by its success serve as a catalyst, and induce volunteers of all kinds (adherents of national associations, correspondents, public authorities and personalities) to reveal themselves.

2. Technical exhibitions and international competitions.

3. Publicizing action.

4. Comparison of professional and social conditions in countries and deduction of a line of conduct: a line of conduct on which the various national associations will base themselves; conforming to the ethical tendencies in each country; conforming finally to the prevailing state of affairs in each country. This is important: a line of conduct purely ideal, and despising these fundamentals would sooner or later generate defeats and dissensions.

Professional Journal.—There are three problems to solve which interpenetrate:—

1. *Contents.*—Such a journal to be complete must be technical, informative, and militant.

2. *Presentation.*—It must be good enough, for people will judge it by its face. It will be

necessary in the course of time for advertisements, and the presentation has an influence on the volume of these. "*Le Laboratoire Dentaire*—"The Dental Laboratory", will appear every two months, commencing with five hundred copies. The cover will be printed off in advance in the shape of a pasteboard wrapper. Each adherent association will transmit each second month, for example on the 20th, an article of 2 leaves (4 pages), extracted from its national magazine and set up with its double destination in view. It is difficult to ask all our members to contrive the standardization of the format of their journals, but it is possible in starting new ones. They would be asked to print off on the standard format 500 extra copies which would be sent to the secretary for binding in the covering wrapper.

This proceeding will give at the very beginning a living journal, well printed, well presented, while awaiting sufficient publicity for the financing of a journal edited autonomously; but it will require certain discipline and detail in the layout of the page, so as to be able to carry out in easy conditions the second binding. Should the article in question be in English, room must be left for a summary in French and other languages. To sum up, this method is possible on condition of the observation of a few directions which would be provided by the secretary in good time if the principle is adopted.

3. *Financial.*—To assure proper management we need a sum which it is difficult to estimate, but basing on past experience, we submit the following provisional figures:—

Salaries in extra hours using personnel already functioning	240,000 frs.
Covers, printing and binding	60,000
Mailing, translations, stationery	100,000
Suppose for one year (1000 frs. = £1)	400,000 frs.

When once the decisions are taken, and procedure agreed upon, the work of the secretary in these domains will be somewhat engrossing in consequence of the intervals of transmission and necessary translations, the editing of circulars and folders, the steps to be taken about contacting public bodies, the radio stations, the cinema, and television.

The edition of a questionnaire will be necessary, to which the national associations must reply. The compilation of the replies will permit the drawing up of a precise plan on professional organization by means of international action.

Except by possible revision of the plan, the questions will be the sole domain of the national associations. By this separation of the national and international domains, will be avoided involuntary and indirect injuries to the national thoughts and aspirations, which are often an explanation of the suppression of international organizations.

The question of the journal was discussed for a long time. It was decided to adopt a format $9\frac{1}{4} \times 6\frac{1}{4}$ in. The Italians guaranteed to be responsible for the initial cost of covers, binding, and printing. The periodicals will be sent in packets to each country: the national associations must pay for their distribution: it was difficult to establish an exact costing, this depended on the number of members in 1954. M. Oosterbosch will receive the drafts of articles, and decide what is necessary to print, while awaiting the constitution of an editorial committee.

Subscriptions.—M. Oosterbosch proposed that they might consider asking for a subscription in the region of 56 French francs per member, reckoning in blocks of fifty members. For each block of 50 members the national association would owe a subscription of 2,800 frs. as the following:

1– 50 members		2,800 frs.
51–100	„	5,600 „
101–150	„	8,400 „

and so on at the rate of 2,800 frs. per commencement of each block of 50 members. Nevertheless each national association will have the right to send to the provisional committee proposals relative to the subscription (article 10). The subscription of correspondence members (article 7) is left to their own choice. The submission of this plan to the assembly in Milan was approved by the committee.

The sitting ended at 8.15 p.m.

NEWS FROM HEAD OFFICE

Disputes Committee Rules and Procedure.—Draft rules have been framed for consideration by the Employers' side prior to their submission to the National Joint Council, and various additions and amendments have been suggested by S.I.M.A. which it is hoped will be incorporated in the final draft.

N.J.C. Indenture Form.—After consultation with our legal adviser, proposals have been formulated for the revision of the Model Indenture and these will be considered at the next meeting of the N.J.C.

Termination of Indentures.—Attention is called to the fact that when indentures are terminated by mutual consent, the cancellation should be effected by a deed discharging all parties from their obligations under the indenture. A verbal agreement or an exchange of letters only may lead to future difficulties.

We are advised that where an apprentice volunteers to join the R.A.F. as a tradesman for a three-year period, this constitutes a breach of the indenture unless the contract is terminated by agreement between all the parties concerned. If the normal period of national service is exceeded there is no obligation on the employer to reinstate the apprentice on his return to civilian life.

Fabrication of Dentures and Appliances by a Health Centre.—Representations were made to the Ministry of Health regarding a circular issued to Hospital Management Committees by a Regional Dental Officer intimating that denture work, including repairs and the provision of splints, could be undertaken for hospitals at certain specified prices which were quite uneconomic. This matter is being pursued by S.I.M.A., and in the meantime members are asked to inform us if they hear of any similar action in their areas.

City and Guilds Award.—After consultation with the Branches, the Main Committee has decided to make a national award on behalf of S.I.M.A. to the best student in the City and Guilds courses throughout the country each year. The award will take the form of a book and the most suitable occasion for the presentation will be decided by the Committee in due course.

Summer Conference.—The arrangements for the Summer Conference which will be held in Birmingham next June are in the hands of the Birmingham Branch. A talk and film on Eye Implants is in contemplation, together with a demonstration of the processes in the fabrication of artificial eyes. It is also hoped that the Plastic Surgery Unit at Worsley Hospital will give an exhibition of plastic surgery and maxillo-facial work.

New Member.—Mr. E. T. Back, 64, Heathwood Road, Cardiff.

Changes of Address.—The following new addresses should be noted:—

The Pearson Dental Laboratory, 9, Selborne Villas, Clayton, Bradford.

The Pembroke Dental Laboratory, "Melrose", The Promenade, Neyland, Pem.

WEEK-END CONFERENCE, 1954

Programme

Headquarters: Holborn Restaurant
London, W.C.1.

Friday, Feb. 12

ANNUAL DINNER AND DANCE

Reception 6 p.m.; Dinner 6.30 p.m.
Dancing and Entertainment 8 to 11.30 p.m.
Tickets 31s. each, double 60s. from:
Mr. C. M. Booth, 26, Palmerston Road, Wood Green, London, N.22.

Saturday, Feb. 13

ANNUAL GENERAL MEETING, 10.30 a.m.
Informal Luncheon 1 p.m. to 2.15 p.m.

EXHIBITION OF DENTAL LABORATORY EQUIPMENT, APPLIANCES, AND TECHNIQUES
2.30 p.m.
(To be given by members of the A.D.M.T.)
Admission by ticket only, free from Mr. Booth.